

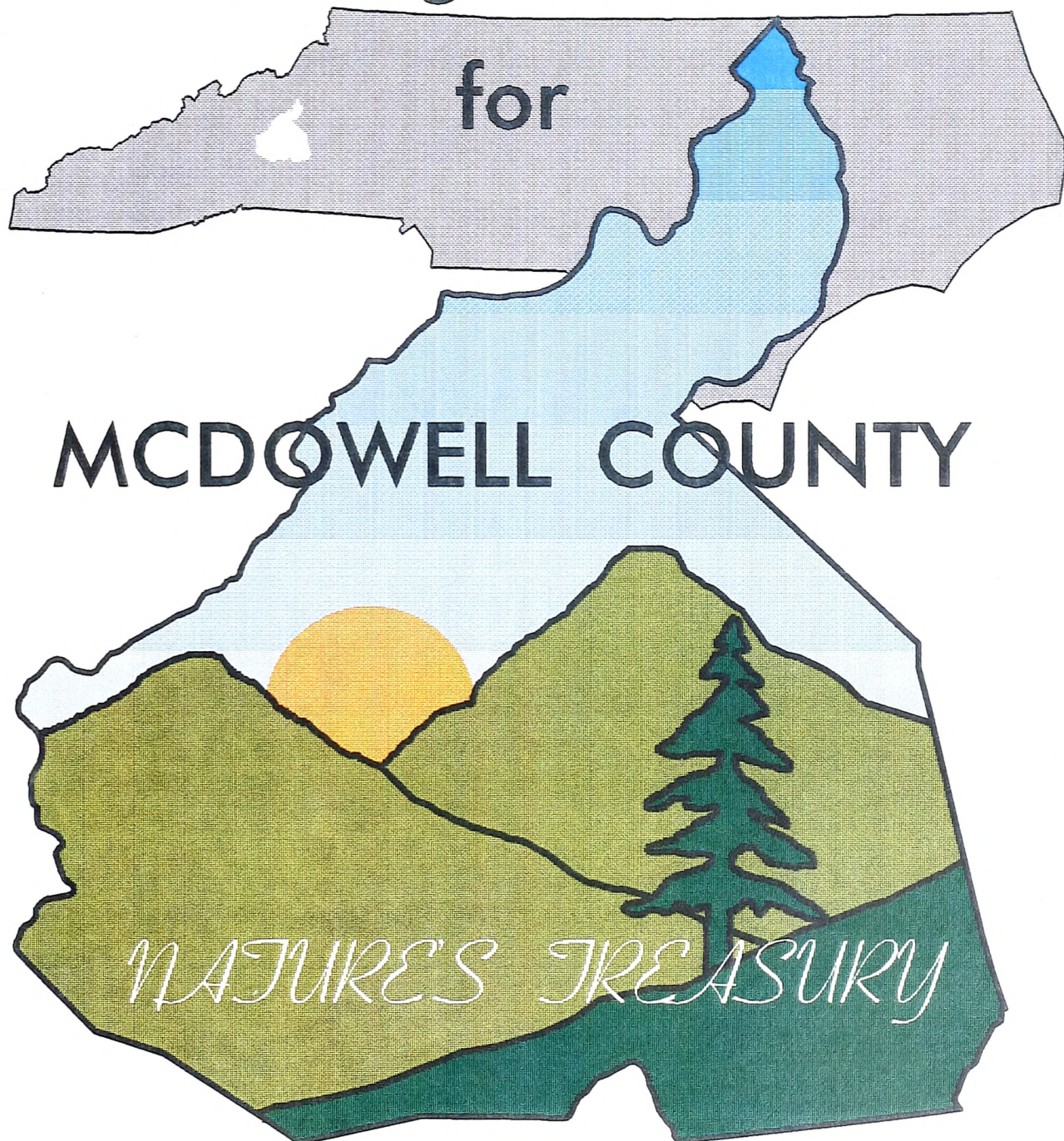
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North Carolina Department of Transportation
Statewide Planning Branch
Small Urban Planning Unit

Thoroughfare Plan



December, 1995

McDOWELL COUNTY THOROUGHFARE PLAN

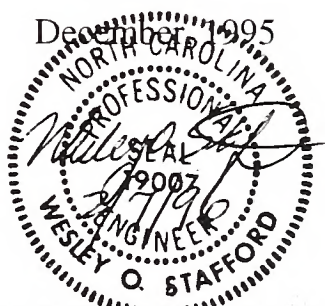
INCLUDING OLD FORT AND MARION

Prepared by the:

Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

In cooperation with:

McDowell County
Town of Old Fort
City of Marion
The Federal Highway Administration
U. S. Department of Transportation



Wesley O. Stafford, P.E.
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ACKNOWLEDGEMENTS

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Chapter 1

Introduction

Overview

Officials of McDowell County, prompted by a desire to adequately plan for the future transportation needs of McDowell County, requested the North Carolina Department of Transportation's (NCDOT) assistance in conducting a thoroughfare plan study. Since the County's transportation concerns were systemwide, including the Towns of Marion and Old Fort, it was agreed that the thoroughfare plan study for McDowell County should also include an update of the Marion and Old Fort thoroughfare plans. The primary concern identified by McDowell County officials was the need to develop a means of identifying and prioritizing projects for inclusion in the North Carolina Transportation Improvement Program. Other specific transportation needs were also identified.

The objective of thoroughfare planning is to enable the transportation network to be progressively developed to adequately meet the transportation needs of a community or region as land develops and traffic volumes increase. By not planning now for our future transportation needs, unnecessary costs to the physical, social, and economic environment may very well be incurred. Thoroughfare planning is a tool that can be used by local officials to plan for future transportation needs, while at the same time reducing the costs to our environment.

The primary purpose of this report is to present the findings and recommendations of the thoroughfare plan study conducted for McDowell County. The secondary purpose of this report is to document the basic thoroughfare planning principles and procedures used in developing these recommendations. This report can be divided into three parts. The first part of the report, covered in Chapter 1, reviews the highlights of the study. Chapters 2 and 3 provide a detailed description of the Thoroughfare Plan study recommendations and address different methods by which these recommendations can be implemented. The final chapter, Chapter 4, covers study procedure and findings.

Information that will be especially useful to the practitioner is provided in the Appendix. The principles of thoroughfare planning are covered in Appendix A, a detailed tabulation of all routes on the Thoroughfare Plan and a graphical representation of typical cross-sections can be found in Appendix B and Appendix C respectfully. The information related to subdivision ordinances is covered in Appendix D. Appendix E provides an index that can be used for cross referencing secondary road numbers and names. Other information contained in the Appendix includes the findings of the Old Fort Thoroughfare Plan study (Appendix F) and the findings of the Marion Thoroughfare Plan assessment (Appendix G).

Background

McDowell County is located in western North Carolina along the foothills of the Blue Ridge Mountains. With 67,000 acres of Pisgah National Forest lands, 60 miles of trout streams, and over 70 miles of hiking trails, it is easy to see why travel and tourism is a basic building block for McDowell County's economy. Other special features within the County or located nearby include access to the Blue Ridge Parkway, Lake James and the Lake James State Park, Linville Caverns, Linville Falls, and Mt. Mitchell.

Manufacturing comprises approximately 58% of the County's work force. The chief products produced include furniture, textiles, pharmaceuticals, automotive carpet, telecommunications equipment, paper boxes, piping, plywood, and metal fabrication. In addition to a diversified economy, outstanding natural resources, strong health services, and opportunities in commercial and recreational development, McDowell County also takes an active role in transportation planning and the development of an extensive roadway network. The major routes in McDowell County include: I-40, US 221, US 70, US 64, NC 226, and NC 80.

Highlights

Major highlights of the 1995 McDowell County Thoroughfare Plan are outlined below. The Thoroughfare Plan map is shown in Figure 1. Projects included in the 1996-2002 Transportation Improvement Program (TIP) are shown in parenthesis.

1. Widen US 221 to a multilane facility. (R-2596, R-2597, R-204, R-2020)
2. Widen US 70 to a 4-lane divided facility from Marion to Old Fort, make 2-lane improvements from Marion east to the Burke County Line.
3. Widen NC 226 to a 5-lane urban facility from I-40 to US 221 (R-2609), a 4-lane divided facility from I-40 south to Harmony Grove Road, and 2-lane improvements from Harmony Grove Road to the Rutherford County Line and from US 221 north to NC 226A.
4. Widen Sugar Hill Road (SR 1001) to a 5-lane urban facility from I-40 to the Marion US 221 Bypass. (R-2643)
5. Widen US 64 to a 4-lane divided facility to provide a regional multilane route.
6. Roadway improvements along Hankins Road.
7. Roadway improvements to NC 126.

The North Carolina DOT and McDowell County are jointly responsible for the proposed thoroughfare improvements. Cooperation between the State and the County is of primary concern if the recommendations outlined above are to be successfully implemented. The plan has been mutually adopted by all parties, and it is the responsibility of the County to implement the plan following guidelines set forth in Chapter 3.

It is important to note that the recommended plan is based on anticipated growth within the County as indicated by past trends and future projections. Prior to construction of any of these projects, a more detailed study will be required to revisit development trends and to determine specific locations and design requirements.

LEGEND		
	EXISTING	PROPOSED
INTERSTATE		
PRINCIPAL ARTERIAL		
MINOR ARTERIAL		
MAJOR COLLECTION		
MINOR COLLECTION		
URBAN MAJOR		
URBAN FREEWAY		
URBAN PLANNING BOUNDARY		

ADOPTED BY: _____

MEDOWELL COUNTY _____ September 18, 1993

N.C. DEPT OF TRANSPORTATION _____ December 5, 1993

RECOMMENDED BY: _____

STATEWIDE PLANNING BRANCH _____ October 30, 1993 *in hand*

PUBLIC HEARING DATE _____ August 31, 1993

SCALE FOR ENLARGEMENTS

FIGURE 1

Chapter 2

Recommended Thoroughfare Plan

Intent of the Thoroughfare Plan

Transportation is the backbone of a regions economic vitality. Without an adequate transportation system people cannot easily reach their intended destination, goods cannot be delivered to market in a cost effective manner, and investors may look to invest in better served areas. Recent trends such as regional economies, “just in time” delivery, increased automobile ownership, and increased migration away from the central cities and towns are taxing our existing transportation system and requiring that we put more emphasis on planning for our transportation future.

A thoroughfare plan study identifies existing and future deficiencies in the transportation system, as well as uncovers the need for new facilities. The thoroughfare plan also provides a representation of the existing highway system by functional use. This use can be characterized as a part of the arterial street system, the collector street system, or the local street system. A full description of these various systems and their subsystems is given in Appendix A.

This chapter presents the thoroughfare plan recommendations. It is the goal of this study that the recommended plan set forth a transportation system that will serve the anticipated traffic and land development needs for McDowell County. The primary objective of this plan is to reduce traffic congestion and improve safety by eliminating both existing and projected deficiencies in the thoroughfare system.

Thoroughfare Plan Recommendations

Interstate

I-40

This interstate highway is a major east-west facility through McDowell County. I-40 connects the state of North Carolina from the Ports in Wilmington to and through the Blue Ridge Mountains and into the state of Tennessee. This route is important not only to interstate commerce, but also to travel and tourism the life blood of many Towns in the North Carolina mountains. Traffic projections indicate that I-40 through McDowell County will be under capacity through the planning year 2025. However, attention should be paid to the eastern portion, between NC 226 and Burke County, as forecasts indicate that this section will be approaching capacity by the year 2025.

Principal Arterials

US 221

US 221 has been identified as part of North Carolina's Intrastate System. This route provides a major north-south route between South Carolina and the mountains of North Carolina and its popular ski areas and mountain attractions. US 221 parallels the Blue Ridge Mountains eventually leading into the state of Virginia. Much of the traffic using this corridor is traffic traveling through McDowell County and is regional in nature.

Most of the growth in local traffic along this route is likely to occur north of Marion through the Woodlawn community and south through the Glenwood community. Many natural features in McDowell County prohibit development throughout this corridor. These include the Pisgah National Forest, topographic constraints, and environmental concerns. However, the communities of Woodlawn and Glenwood provide prime areas for future development due to the relatively flat terrain and plans for future expansion of water service into these areas. Traffic increases on US 221 in the northern most portion of the County will most likely result from increases in through traffic. Land development in this area will be slower due to environmental and topographic constraints.

The rate of growth for traffic along this facility is projected to range from a high of 3 percent per year for the central and southern portions of the route, to a low of 2 percent for the northern portion of the route. An analysis of this route indicates that US 221 from US 221 Business to NC 226 is currently over capacity. By the design year 2025, additional portions of this roadway will be either over capacity or approaching capacity. US 221 from I-40 to Marion and from NC 226 to Peppers Creek Road (SR 1566) will be over capacity. The section from Rutherford County to I-40 will be approaching capacity.

To accommodate future increases in traffic and to maintain the future integrity of this route as an intrastate facility, it is recommended that US 221 be widened to provide a multilane section from Rutherford County to the Blue Ridge Parkway.

Minor Arterials

US 64

US 64 crosses the southern tip of McDowell County. From a regional perspective, US 64 in combination with NC 18 provides an excellent intrastate route connecting Lenior, Morganton, and Rutherfordton. From Rutherfordton, US 74 and I-26 can be easily accessed. Improving this route to a 4-lane divided facility would provide a welcomed economic boost throughout this corridor. Improvements to this route would also reduce the cost of intrastate commerce by providing improved access between industrial development in the North Carolina foothills to destinations in western North Carolina and northern South Carolina.

NC 126

Lake James is located in the northeastern portion of McDowell County. NC 126 provides access into this region from US 70 through the Nebo community. Land development in this region of the County has recently increased and this trend is likely to continue.

Although traffic forecasts for this roadway are not shown to be exceeding the roadways capacity, the increased use of this route for both local traffic and visitors to the Lake James State Park warrants some concern for potential safety considerations given existing geometry and roadway width. To improve safety and efficiency it is recommended that NC 126 be widened to provide 3.66 meter (12-foot) lanes and paved shoulders. Where feasible, the alignment should be improved to eliminate dangerous horizontal curves.

Major Collectors

US 70

This facility provides a parallel route to I-40. Although there is some regional traffic that uses this route, most of the trips on this roadway are local. The Old Fort community provides a pocket of industrial development supplying many jobs for the residents of McDowell County. US 70 is the main route for work trips originating in Marion and Pleasant Gardens traveling to the work sites in Old Fort. East of Marion US 70 provides access to the growing areas of Nebo and Lake James. US 70 provides a regional travel corridor for traffic from Marion and Nebo traveling to work in Burke County and Morganton.

McDowell County's Land Use Plan indicates that the US 70 corridor is a target zone for water and sewer expansion. Putting water and sewer in place will encourage development through this corridor. Other factors that will encourage development along this corridor include good topography and the identification of additional land south of Old Fort for future industrial growth. Past trends show traffic increases along this route ranging from one to ten percent per year with the largest growth occurring within the Town of Marion. Based on projected increases in population and land development through this corridor, it is estimated that traffic will continue to increase at an average annual rate of 2 - 2.5 percent.

At this rate of growth, the US 70 corridor will be over capacity between Old Fort and Marion, and approaching capacity east of Marion to NC 126 by the planning year 2025. To accommodate the increases in traffic and to maintain this route as a safe and efficient alternate to I-40, it is recommended that the section of US 70 between the Old Fort Planning Boundary (near Curtis Creek Road) and the Marion Planning Boundary (near Major Conley Road) be widened to provide a 4-lane divided highway. US 70 from the eastern planning boundary of Marion should be widened to provide 3.66 meter (12-foot) travel lanes, paved shoulders, and turn lanes at major intersections.

NC 226

This route has been designated as a scenic byway and provides regional access from Shelby through Marion and into the North Carolina mountains. Development along the northern portion of NC 226 is somewhat restricted due to park lands, the watershed, and topographic constraints. For this reason, increases in traffic volumes for this section of NC 226 are likely to be low to moderately low and will result primarily from increases in through traffic.

NC 226 south of Marion has a much stronger potential for growth and development. This corridor currently supports the McDowell Technical Community College, the North Carolina Department of Transportation District Field Offices, State Highway Patrol Center, a prison facility, and the Universal Furniture manufacturing plant. A regional prison has recently been built in this vicinity with prisoners scheduled to arrive midsummer. There are also plans for future expansion of this facility.

Analysis of this facility indicates that NC 226 from I-40 to the Marion Urban Planning Boundary (South of the intersection with US 221) is currently over capacity. Traffic projections for the year 2025 show NC 226 from I-40 to Harmony Grove Road (SR 1760) over capacity, and from US 221 to NC 226A approaching capacity. It is recommended that the following improvements be made to accommodate the growth in traffic. The section between I-40 and the Marion Planning Boundary should be widened to a 5-lane urban section. For NC 226 south of I-40 to Harmony Grove Road, a 4-lane divided section is recommended. The remaining portion from Harmony Grove Road to the Rutherford County line should be widened to provide two 3.66 meter (12-foot) lanes with paved shoulders. Since NC 226 has been designated as a NC Scenic Byway, this widening should be done in such a manner as to preserve the scenic quality of this route. To improve safety and traffic operations along the northern portion, it is recommended that NC 226 from US 221 to NC 226 Alt. be widened to provide two 3.66 meter (12-foot) lanes and paved shoulders.

Minor Collectors

Sugar Hill Road (SR 1001)

Connecting southwest Marion to I-40, Sugar Hill Road is located in an area of the County that has been identified as limited urban transition. Targeted for future expansion of water service, this area is likely to foster strong development in the future. An analysis of 1994 traffic volumes for Sugar Hill Road indicates that traffic heading north from I-40 to Marion is approaching capacity. The 1995-2001 Transportation Improvement Program has identified this route for improvements to a multilane facility. In keeping with the TIP, it is recommended that Sugar Hill Road be widened to a 5-lane urban section.

Hankins Road (SR 1501)

The land around Hankins Road has experienced a high level of residential development over the past few years. This trend in residential development is expected to continue. Increases in residential development will generate additional traffic along this route. To

improve safety and to accommodate the future traffic growth in traffic this roadway should be widened to provide two 3.66 meter (12-foot) lanes with paved shoulders. Turn lanes should be provided at major intersections. Careful coordination with developers can help to assure that roadway improvements, especially turn lanes, will be provided along this route as land development continues.

Other

Access from I-40 to Lake James Area

Travelers in McDowell County can access the Lake James area from I-40 via Harmony Grove Road (SR 1760) and Stacey Hill Road (SR 1747). These routes are functionally classified as minor collectors and carry average daily traffic volumes ranging from 1,600 to 3,000 vehicles per day. The existing cross-section for both routes is a 2-lane narrow, winding roadway with no shoulders. Although this route is functional, the development of the Lake James area may warrant an improved connection between I-40 and US 70 in the future. In addition to the increased development of Lake James, other development prospects being pursued by the County that might warrant these improvements include a new County Airport and the location of a new industrial park.

New Interchange at I-40 and Muddy Creek Road

The feasibility of providing an interchange on I-40 at Muddy Creek Road (SR 1763) was investigated, but does not appear feasible at this time. The addition of a new interchange to the Interstate System requires a decision from the Federal Highways Administration which is based upon an Interchange Justification Study. Prior to conducting a full Interchange Justification Study, several preliminary factors can be reviewed to determine if a more detailed analysis is warranted. These factors include spacing between interchanges, the purpose the additional interchange will serve, and a consideration of alternatives to adding the new interchange. The findings associated with these preliminary factors are outlined below:

Spacing

The proposed interchange is located 3.71 km (2.3 miles) east of Interchange 90 in McDowell County, and 3.23 km (2.0 miles) west of Interchange 94 in Burke County. According to A Policy on Geometric Design of Highways and Streets, Chapter 10, Page 984, 1984:

“A generalized rule of thumb for minimum interchange spacing is one mile in urban areas and two miles in rural areas.”

Using this guideline, the proposed Muddy Creek Interchange would meet the spacing requirement.

Purpose

The purpose of the Interstate System is to serve regional traffic not local traffic. Guidelines pertaining to the purpose of the proposed interchange are presented in "Additional Interchanges to the Interstate System", Federal Register, Volume 55, No. 204, October 22, 1990, which require:

"... States to demonstrate that an access point is needed for regional traffic needs and not only to solve local system needs or problems."

The proposed Muddy Creek Interchange would provide access to Lake James State Park, a new County Airport (contingent upon final location approval), and a proposed industrial park. The Lake James State Park does attract some traffic that is regional in nature. However, the attraction to the County Airport and the industrial park would most likely be from McDowell County and neighboring Burke County. This level of attraction is relevant to the bi-county area, but is not considered to be regional in nature.

Alternatives

The Federal Register previously mentioned also states that for a new interchange to be warranted, it is necessary to:

"... assure that all reasonable alternatives, including improvements to existing local roads and street in lieu of new access, have been fully considered."

An existing interchange located 3.7 km (2.3 miles) west of the proposed interchange provides access to US 70 and the Lake James area. Access from I-40 to this area is currently gained by utilizing narrow 2-lane roadways with no shoulders. Improvements to existing routes as well as possible consideration of new routes that would provide access to the County Airport, industrial park, and Lake James State Park would negate the need for an additional interchange at Muddy Creek Road by providing a satisfactory alternative.

Other Factors

The construction of a new interchange at Muddy Creek Road would also be impaired by the location of Muddy Creek which runs parallel to and crosses under I-40 in this area. Given the other factors outlined above, it may be difficult to justify the impact to this existing creek by the construction of interchange ramps.

Conclusion

Although the addition of a new interchange on I-40 at Muddy Creek Road appears to meet the minimum spacing requirement for new interchanges, the preliminary findings related to purpose and consideration of alternatives indicates that an interchange at this location is not warranted at this time.

Public Involvement

The McDowell County Thoroughfare Plan was officially started in August of 1994 by way of a joint meeting with representatives from the NCDOT, County of McDowell, City of Marion, Council of Governments, and the local Chamber of Commerce. The McDowell County Planning Board became an active part of the process in November of the same year. On May 16, 1995, preliminary findings were presented to the Planning Board. Upon recommendation of the Planning Board, these findings were presented to the McDowell County Commissioners on July 17, 1995. The public was present at this meeting and comments were received from the Commissioners. On August 16, 1995, a public drop-in session was held to discuss the findings of the Thoroughfare Plan study with members of the public on a one-to-one basis. There were no members of the public in attendance.

The Public Hearing was held on August 21, 1995. Members of the public were present, and comments were received. Most comments were addressed during the course of the Hearing. However, two questions required further investigation. These questions involved the US 221 widening project (TIP R-2596) and the recommended widening of a North Carolina Scenic Byway. At the close of the Public Hearing, the County Commissioners moved to defer the adoption of the Thoroughfare Plan until the questions regarding the NC Scenic Byways and US 221 proposed cross-section could be addressed. These concerns were addressed with a follow-up letter to a McDowell County citizen, and McDowell County Manager with a copy to NC House Representative Robert Hunter. The McDowell County Thoroughfare Plan was then adopted unanimously at the September 18, 1995 Commissioners meeting. This Plan was adopted by the North Carolina Board of Transportation on December 8, 1995.

Chapter 3

Implementation of the Thoroughfare Plan

Once the thoroughfare plan has been developed and adopted, implementation is one of the most important aspects of the thoroughfare plan. Unless implementation is an integral part of this process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the County to assist in the implementation of the thoroughfare plan. They are described in detail in this Chapter.

State-County Adoption of the Thoroughfare Plan

McDowell County and the North Carolina Department of Transportation (NCDOT) have mutually adopted the thoroughfare plan shown in Figure 1. This mutually adopted plan can serve as a guide for the NCDOT in the development of the road and highway system for the County. The approval of this plan by the County also enables standard road regulations and land use controls to be used effectively in the implementation of this plan.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the County Planning Commission a plan of any proposed subdivision. It also requires that the subdivisions be constructed to meet certain standards. This process can be used to require the subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for planned roads and highways that are to become a part of the thoroughfare plan. The construction of subdivision streets to adequate standards reduced maintenance costs and simplifies the transfer of streets to the State Highway System. Appendix D outlines the recommended subdivision design standards as they pertain to road construction.

Land Use Controls

Land use regulations are an important tool in that they regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by requiring sufficient setbacks to provide for adequate sight distances and by requiring off-street parking.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the NCDOT. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff from the Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design

Unit of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility while preserving the integrity of the thoroughfare plan.

Funding Sources

Capital Improvements Program

A local capital improvement program makes it easier to build a planned thoroughfare system. A capital improvement program consists of two lists of projects. The first is a list of highway projects that are designated as a municipal responsibility and are to be implemented with municipal funds. The second is a list of local projects designated as State responsibility to be included in the Transportation Improvement Program. These funds are generally not applicable for county thoroughfare plans.

Transportation Improvement Program

North Carolina's Transportation Improvement Program (TIP) is a document which lists all major construction projects the Department of Transportation plans for the next seven years. Similar to local Capital Improvement Program projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programmed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities and counties request projects to be included in the TIP. A Board of Transportation member reviews all of the project requests in a particular area of the State. Based on the technical feasibility, need, and available funding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are also available for other projects such as: bridge replacement, highway safety, public transit, railroad crossings, and bicycle facilities.

Industrial Access Funds

If an Industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Small Urban Funds

Small Urban funds are annual discretionary funds made to municipalities with qualifying projects. The maximum amount is \$1,000,000 per division per year. A town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer.

The North Carolina Highway Trust Fund Law

The Highway Trust Fund Law was established in 1989 as a plan with four major goals for North Carolina's roadway network. These goals are:

1. To complete the remaining 2,768 km (1,716 miles) of four lane construction on the 5,806 km (3,600 mile) North Carolina Intrastate System.
2. To construct a multilane connector in Asheville and portions of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.
3. To supplement the secondary roads appropriation in order to pave, by 1999, 16,129 km (10,000 miles) of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.
4. To supplement the Powell Bill Program.

The portion of this bill which will most benefit McDowell County is the paving of most, if not all, of the unpaved roads on the State maintained system by the end of the planning horizon. For more information on the Highway Trust Fund Law, contact the Program Development Branch of the North Carolina Department of Transportation.

Implementation Recommendations

The following table provides a break down of the projects recommended in the McDowell County Thoroughfare Plan and the corresponding method that would best suit the implementation of the given project.

Table 1
Funding Sources and Recommended Methods of Implementation

<i>Projects</i>	<i>Funding Source</i>				<i>Method of Implementation</i>			
	<i>Local Funds</i>	<i>TIP</i>	<i>Indust. Access</i>	<i>Small Urban</i>	<i>Tho. Plan</i>	<i>Subd. Ordinc.</i>	<i>Zoning</i>	<i>Devlp. Reviews</i>
US 221		X			X			X
US 70		X			X			X
US 64		X			X			X
NC 226		X			X			X
NC 126		X			X			X
Sugar Hill Rd		X			X			X
Hankins Rd					X			X

Construction Priorities and Cost Estimates

Construction priorities vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more important than minor thoroughfares where traffic volumes are lower. To be in the North Carolina Transportation Improvement Program, a project must show favorable benefits relative to cost and should not be prohibitively disruptive to the environment.

Reduced road user cost should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facilities have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the 32 year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is shown as the probability that it will stimulate the economic development of an area by providing access to developable land and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (representing no development potential) to 1.00 (representing excellent development potential).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Below is a list of the thirteen items that are considered when evaluating the impacts on the environment:

- air quality
- water resources
- soils and geology
- wildlife
- vegetation
- neighborhoods
- noise
- educational facilities
- churches
- parks and recreation facilities
- historic sites and landmarks
- public health and safety
- aesthetics

The environmental impact analysis also uses a probability rating from 0 to 1.00. A negative value is assigned to the probability to indicate a negative impact. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project. Table 2 shows the probability scale used in the analysis. This table can be used as a guideline for interpreting the "Economic Development" and "Environmental Impact" values given in Table 3.

Table 2
Probability Estimation Guide

<i>Subjective Evaluation</i>	<i>Impact Probability</i>
Excellent - Very Substantial	1.00
Very good - Substantial	0.75
Good - Considerable	0.50
Fair - Some	0.25
Poor - None	0.00

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report were derived using current estimates for roadway construction in North Carolina. The anticipated right-of-way costs were broken out of the total project cost using an average cost per acre for property throughout McDowell County according to the respective project.

The potential cost estimate of the major McDowell County projects with respect to the user benefits, and the probabilities that economic development will be stimulated and environmental impacts will be minimized are given in Table 3.

Table 3
Benefits Evaluation for Major Projects

<i>Project</i>	<i>Benefits (millions)</i>	<i>Cost (millions)</i>	<i>Length (km)</i>	<i>Benefits/ km</i>	<i>Economic Develpmnt.</i>	<i>Envirn. Impact</i>
NC 226 - A	146.6	4.3	1.67	86.0	0.38	+0.7/-0.1
NC 226 - B	108.1	8.2	3.87	28.0	0.44	+0.6/-0.2
NC 226 - C	21.1	16.7	15.37	1.4	0.13	+0/-0.1
NC 226 - D	13.3	2.1	2.10	6.3	0.03	+0.2/-0.1
Hankins Road	61.8	8.1	7.85	7.9	0.75	+0.3/0
US 221	37.8	10.1	4.76	7.9	0.53	+0.2/-0.1
US 70 West	453.5	26.2	12.0	37.8	0.75	+0.5/-0.2

NC 226 - A: I 40 to US 221

NC 226 - B: I 40 to Harmony Grove Rd.

NC 226 - C: Harmony Grove Rd. to Rutherford County

NC 226 - D: US 221 to NC 226 Alt.

Table 4 provides a break down of total project cost into construction cost and right-of-way cost for the major project proposals on the Thoroughfare Plan.

Table 4
Potential Project Cost Estimates for Major Projects

<i>Project Description</i>	<i>Construction Cost</i>	<i>Right-of-way Cost*</i>	<i>Total Cost</i>
NC 226 - A	\$2,630,250	\$1,664,865	\$4,295,115
NC 266 - B	\$7,616,025	\$542,275	\$8,158,300
NC 226 - C	\$16,046,550	\$623,450	\$16,670,000
NC 226 - D	\$2,047,500	\$86,100	\$2,133,600
Hankins Road	\$7,789,275	\$325,125	\$8,114,400
US 221	\$8,925,000	\$1,164,100	\$10,089,100
US 70	\$23,330,700	\$2,873,650	\$26,204,350

* Right-of-way costs estimates were derived using average land costs/acre for McDowell County

NC 226 - A: I 40 to US 221

NC 226 - C: Harmony Grove Rd. to Rutherford County

NC 226 - B: I 40 to Harmony Grove Rd.

NC 226 - D: US 221 to NC 226 Alt.

Table 5 provides a prioritized listing of the major projects proposed on the McDowell County Thoroughfare Plan. Priorities were assigned based on growth in traffic over the planning horizon, potential benefits derived from the project, and immediate and future needs assessment.

Table 5
Improvement Priorities for Major Projects

<i>Project Description</i>	<i>Recommended Cross Section</i>	<i>Construction Cost</i>	<i>Calculated Benefit</i>
First Priority: 1994 - 2005			
US 221, from US 221B to Peppers Crk. Road	5 lane urban / 4 lane divided	part under construction	programmed
Sugar Hill Road, from I 40 to Bypass	5 lane urban	programmed in TIP	programmed
NC 226, from I 40 to US 221	5 lane urban	\$4,295,115	\$143,565,500
NC 226, from I 40 to Harmony Grove Road	4 lane divided	\$8,158,300	\$108,121,700
Second Priority: 2005 - 2015			
US 221, from Goose Crk. Road to NC 226	multilane widening	programmed in TIP	programmed
US 70, from Marion UPB to Old Fort UPB	4 lane divided	\$26,204,350	\$453,525,000
Thrid Priority: 2015 - 2025			
US 221, from NC 226 to Blue Ridge Pkwy.	multilane widening	programmed in TIP	programmed
US 221, from Goose Crk. Road to Co. Line	multilane widening	programmed in TIP	programmed
NC 226, from US 221 to NC 226 Alt.	widening to 28-foot pavement	\$2,133,600	\$13,294,310
Hankins Road, from US 221B to RR crossing	widening to 28-foot pavement	\$8,114,400	\$61,753,310

Chapter 4

Analysis of McDowell County's Roadway System

This Chapter presents an analysis of the ability of the existing street system to serve the area's travel desires. Emphasis is placed not only on detecting the deficiencies, but on understanding their cause. Travel deficiencies may be localized and the result of a substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be caused by the system deficiency such as a need for a bypass, loop facility, construction of missing links, or additional radials.

An analysis of the roadway system must first look at existing travel patterns and identify existing deficiencies. This includes roadway capacity and safety analysis. After the existing picture of travel in the area has been developed, the engineer must analyze factors that will impact the future system. These factors include forecasted population growth, economic development potential, and land use trends. This information will be used to determine future deficiencies in the transportation system.

Current Transportation Plans for McDowell County

Thoroughfare Plans

Thoroughfare plans are a tool to aid officials in the development of an appropriate street system. It is important that the communities within a County, and County officials cooperate as a team in the development of this transportation system. Plan development and implementation jointly undertaken will help ensure the development of an efficient system for travel throughout the County. The following thoroughfare planning studies have been completed for municipalities within McDowell County:

1. City of Marion, plan adopted in 1984. A current assessment of the 1984 Plan is contained in Appendix G.
2. Town of Old Fort, new plan adopted in 1995. A review of this study and the corresponding Thoroughfare Plan can be found in Appendix F.

Transportation Improvement Program Projects

As covered in Chapter 3, the Transportation Improvement Program (TIP) is a seven year project planning document that lists the major transportation improvement projects that the Department of Transportation has planned. These projects include not only roadway projects, but also bridge projects, railroad crossings, bicycle facilities, and public transportation. McDowell County has several roadway projects identified in the 1996-2002 TIP, these projects are listed below:

1. US 70, east of Catawba river bridge to US 70/221B north of Marion. Widen roadway to a five lane curb and gutter facility
2. US 221, NC 226 to the Blue Ridge Parkway. Widen roadway to a multilane facility.
3. US 221, SR 1536 in Rutherford County to SR 1153 in McDowell County. Widen roadway to a multilane facility.
4. US 221, SR 1153 to NC 226 and US 221/NC 226B to SR 1434. Widen roadway to a multilane facility.
5. US 221, SR 1434 to south of NC 226. Widen roadway to a multilane facility.
6. NC 226, Blue Ridge Parkway to US 19E. Upgrade existing two lane roadway.
7. NC 226, I-40 to US 221. Widen roadway to a multilane facility
8. Sugar Hill Road (SR 1001), I-40 to Marion Bypass. Widen roadway to a multilane facility.
9. Access Road, construct a two lane facility to the McDowell County Industrial Park on new location. (Under construction by Division Office)

Existing Travel Patterns and Deficiencies

Traffic Demand

Travel demand is generally reported in the form of average daily traffic counts. Traffic counts are taken regularly at several locations within McDowell County by the North Carolina Department of Transportation. The 1994 average daily traffic counts for McDowell County are shown in Figure 2.

Width and Alignment Deficiencies

North Carolina's standard for highway construction calls for 3.35 meter (11-foot) lanes on all highways with traffic volumes greater than 2,000 ADT (Average Daily Traffic) or design speeds greater than 50 miles per hour. This includes all primary arterials. A 2.74 meter (9-foot) minimum lane width can be tolerated on collector roads with an ADT of less than 4,300 vehicles per day. The minimum level of service for minor collector roads dictates a 40 mph design speed during peak traffic conditions. These standards are summarized below in Table 6.

Table 6
Minimum Tolerable Lane Widths

<i>Average Daily Traffic</i>	<i>Principal Arterials</i>		<i>Minor Arterials</i>		<i>Collectors</i>	
	<i>feet</i>	<i>meters</i>	<i>feet</i>	<i>meters</i>	<i>feet</i>	<i>meters</i>
over 2,000	11	3.35	11	3.35	11	3.35
400 - 2,000	-	-	10	3.05	10	3.05
100 - 400	-	-	10	3.05	9	2.74
below 100	-	-	-	-	9	2.74

There are a number of roadways in McDowell County that have substandard widths. Because of the substantial cost of upgrading all secondary roads to standard, narrow widths may have to be tolerated until sufficient funds are available for improvements. The roads identified as a part of McDowell County's Thoroughfare Plan study are listed below:

- US 221: US 221 Bus - Avery Co
- NC 80: US 70 - Yancy Co
- NC 126: US 70 - SR 1595
- NC 183: US 221 - Burke Co
- NC 226: NC 226A - Mitchel Co
- SR 1001: Rutherford Co - I 40
- SR 1135: SR 1137 - US 221
- SR 1137: SR 1135 - SR 1001
- SR 1168: Marion - US 221
- SR 1191: SR 1137 - Marion
- SR 1434: US 221 - NC 80
- SR 1501: SR 1500 - Garden St
- SR 1536: US 70E - US 70W
- SR 1741: NC 226 - SR 1747
- SR 1747: US 70 - SR 1760
- SR 1760: NC 226 - US 70
- SR 1764: Burke Co - NC 226
- SR 1781: US 221 - US 221N
- SR 1786: US 221S - US 221N
- SR 1802: NC 226 - SR 1781

Capacity Analysis of the Existing System

An indication of the adequacy of the existing major street system is a comparison of the traffic volumes with the ability of the streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with a minimum delay is controlled primarily by the spacing of major devices utilized. Thus, the ability of a street to move traffic can be increased by restricting parking and turning movements, using

proper sign and signal devices, and by the application of other traffic engineering strategies.

Capacity is the maximum number of vehicles that has a reasonable expectation of passing over a given section of a roadway in one direction, or in both directions, during a given period under prevailing roadway and traffic conditions (*Highway Capacity Manual, Special Report 209, 3-9,3-10,3-11, 1994*). Roadway capacities and 1994 average daily traffic for the major thoroughfares in McDowell County are shown in Figure 2. There are currently two facilities in McDowell County that are over capacity, US 221 between US 221 Business and NC 226, and NC 226 between I-40 and US 221. Improvements to US 221 are funded in the most recent TIP, with part under construction and part in the design phase. Improvements to NC 226 is also in the TIP as an identified future need.

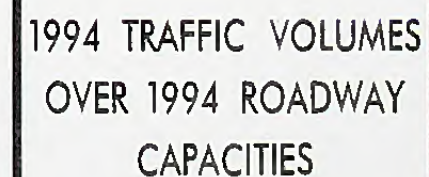
The relationship of traffic volumes to the capacity of the roadway will determine level of service (LOS) being provided. Six levels of service have been selected for analysis purposes. They are given letter designations from A to F with LOS A representing the best operating conditions and LOS F the worst.

The six levels of service are illustrated in Figure 3, and they are defined on the following pages. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them. The 1994 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

LEGEND

Urban Planning Area

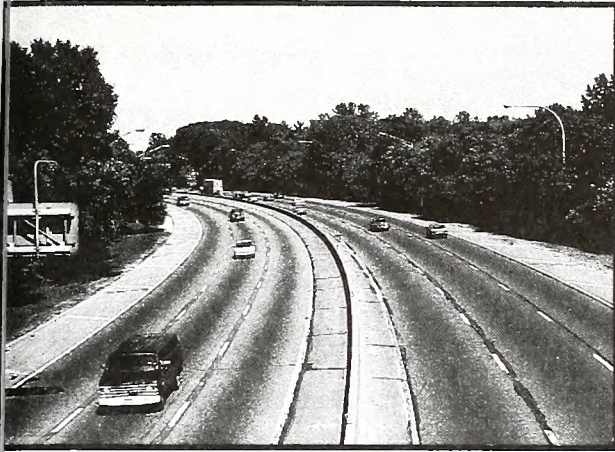
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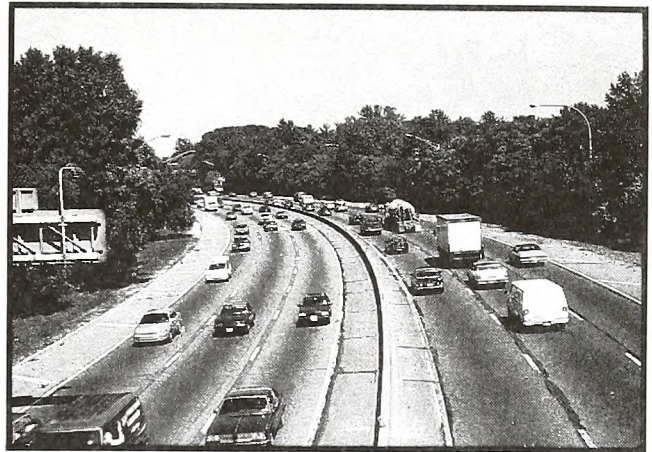
MCDOWELL COUNTY
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAY-STATEMENT PLANNING BRANCH
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

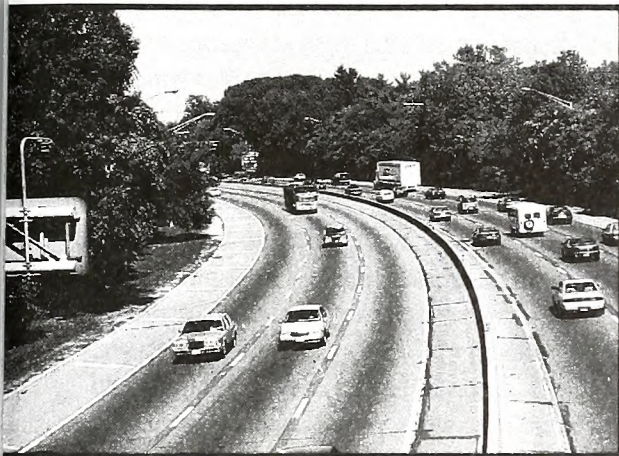




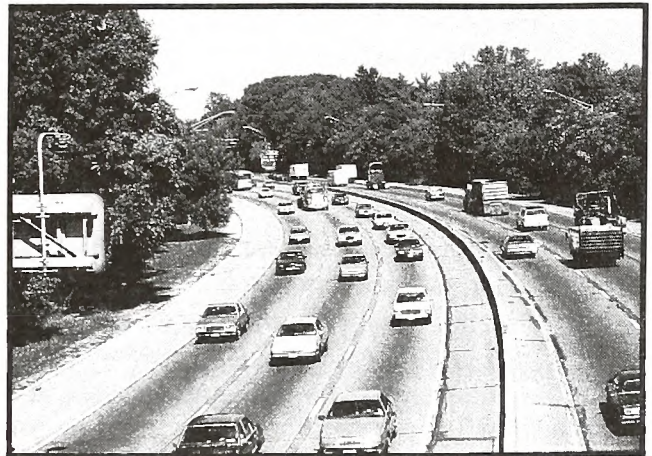
LOS A.



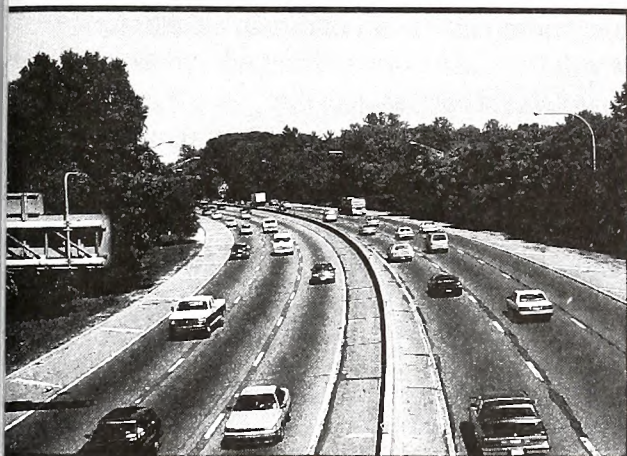
LOS D.



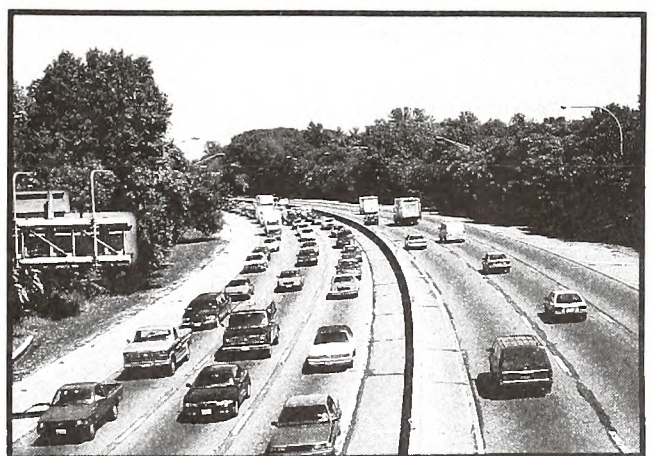
LOS B.



LOS E.



LOS C.



LOS F.

Figure 3
LEVELS OF SERVICE

Levels of Service

LOS A

Describes primarily free flow conditions. The motorist experiences a high level of physical and psychological comfort. The effects of minor incidents or breakdowns are easily absorbed. Even at the maximum density, the average spacing between vehicles is about 158.4 meters or 26 car lengths.

LOS B

Represents reasonably free flow conditions. The ability to maneuver within the traffic stream is only slightly restricted. The lowest average spacing between vehicles is about 99 meters or 18 car lengths.

LOS C

Provides for stable operations, but flows approach the range in which small increases will cause substantial deterioration in service. Freedom to maneuver is noticeably restricted. Minor incidents may still be absorbed, but the local decline in service will be great. Queues may be expected to form behind any significant blockage. Minimum average spacings are in the range of 66 meters or 11 car lengths.

LOS D

Borders on unstable flow. Density begins to deteriorate somewhat more quickly with increasing flow. Small increases in flow can cause substantial deterioration in service. Freedom to maneuver is severely limited, and the driver experiences drastically reduced comfort levels. Minor incidents can be expected to create substantial queuing. At the limit, vehicles are spaced at about 49.5 meters, or nine car lengths.

LOS E

The boundary between LOS D and LOS E describes operations at **capacity**. Operations at this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or changing lanes, requires the following vehicles to give way to admit the vehicle. This can establish a disruption wave that propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate any disruption. Any incident can be expected to produce a serious breakdown with extensive queuing. Vehicles are spaced at approximately six car lengths, leaving little room to maneuver.

LOS F

Describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points.

Traffic Accidents

Traffic accidents are often used as an indicator for locating congestion problems. Traffic accident records can also be reviewed to identify problem locations or deficiencies such as poor design, inadequate signing, ineffective parking, or poor sight distance. Accident patterns developed from analysis of accident data can lead to improvements that will reduce the number of accidents.

Table 7 is a summary of the accidents occurring in MCDowell County between October of 1991 and September of 1994. This table only includes locations with 15 or more accidents, or locations that have less than 15 accidents but demonstrate a pattern in accident type. The "Total" column is the total number of accidents reported within a 61 meter (200-foot) distance of the intersection during the study period indicated. The severity listed is the average accident severity for that location.

Table 7
Locations with 15 or More Accidents in a 3-Year Period

<i>Location</i>	<i>Angle</i>	<i>Ran Off Road</i>	<i>Rear End</i>	<i>Left Turn</i>	<i>Right Turn</i>	<i>Other</i>	<i>Total</i>	<i>Severity</i>
I-40/NC 226	6	2	8	5		2	23	11.61
US 221/NC 226	1	4	14	5	1	2	27	9.37
US 70/SR 1536*			11	1		2	14	11.96
NC 226/SR 1165*			9	3			12	27.31
US 221/US 70	10		21	12	2	7	52	10.57

* less than 15 accidents, but represents a trend in accident types

Both the severity and number of accidents are considered when investigating accident data. The severity of every accident is measured with a series of weighting factors developed by NCDOT's Division of Highways. In terms of these factors, a fatal or incapacitating accident is 47.7 times more severe than one involving only property damage. An accident resulting in minor injury is 11.8 times more severe than one with only property damage.

As a part of this study, these accident locations were reviewed with the Division 13 Traffic Engineer. The Division is actively involved with investigating and improving intersections throughout the County. Table 8 is a summary of the work completed or scheduled for these locations by the Division 13 office. To request a more detailed accident analysis for any of the above mentioned intersections, or other intersections of concern, the County should contact the Division 13 Traffic Engineer.

Table 8
Project Status for Identified Accident Locations

<i>Location</i>	<i>Status</i>
US 221/US 70	Existing signal installed October 1990.
I-40/NC 226	Signal study completed June 1994, signal not warranted at this time. Left turn lanes constructed December 1994, new signal study now in progress.
US 221/NC 226	Existing signal installed October 1990.
US 70/SR 1536	No studies on file or planned at this time.
NC 226/SR 1165	No studies on file or planned at this time.

Existing Bridge Conditions

Bridges are a vital and unique element of a highway system. First, they represent the highest unit investment of all elements of the system. Second, any inadequacy or deficiency in a bridge reduces the value of the total investment. Third, a bridge presents the greatest opportunity of all potential highway failures for disruption of community welfare. Finally, and most importantly, a bridge represents the greatest opportunity of all highway failures for loss of life. For these reasons, it is imperative that bridges be constructed to the same design standards as the system of which they are a part.

Congress enacted the National Bridge Inspection Program Standards on April 27, 1971, implementing the Federal Highway Act of 1968. These standards require that "all structures designed as bridges located on any of the Federal-Aid Highway Systems be inspected and the safe load carrying capacity computed at regular intervals, not to exceed two years." A sufficiency index number has been calculated for each bridge to establish eligibility and priority for replacement. The bridges with the highest priority are replaced as Federal-Aid fund and State funds become available.

The North Carolina DOT's Bridge Maintenance Unit, with assistance from various consultants, inspect all bridges on the State Highway System. All bridges in McDowell County have been analyzed, rated, and inventoried. The resulting data has been reduced to a more readily usable form as a management tool.

A sufficiency rating was used in the analysis to determine the deficiency of each bridge. The sufficiency rating is a method of evaluating factors that determine whether a bridge is sufficient to remain in service. Factors used include:

- structural adequacy and safety
- serviceability and functional obsolescence
- essentiality for public use
- type of structure
- traffic safety features

The result of this method is a percentage in which 100 percent represents an entirely sufficient bridge and zero percent represents an entirely insufficient or deficient bridge. A sufficiency rating of 50 percent or less qualifies for Federal Bridge Replacement Funds.

Deficient bridges are categorized as either functionally obsolete or structurally deficient. Bridges in the functionally obsolete category have below average ratings in approach roadway alignment, under clearance, deck geometry, waterway adequacy, or structural condition. Structurally deficient bridges have below average ratings in deck superstructure, substructure, overall structural condition, or waterway adequacy. Table 9 shows the functionally obsolete bridges in McDowell County. Table 10 shows the ten most structurally deficient bridges in McDowell County.

Table 9
Functionally Obsolete Bridges in McDowell County (ratings < 50.0)

<i>Bridge No.</i>	<i>Facility Carried</i>	<i>Location</i>	<i>Rating</i>
11	SR 1798	0.2 mi SW of SR 1800	49.4
23	NC 80	100 ft S of SR 1436	45.0
42	SR 1163	0.4 mi N of SR 1135	34.6
52	SR 1105	0.05 mi S of SR 1106	47.8
85	SR 1274	1.6 mi W of SR 1254	35.0
96	US 70	200 ft E of SR 1432	49.1
141	SR 1409	50 ft W of SR 1408	49.3
177	SR 1240	0.2 mi N of SR 1135	48.8
204	SR 1102	0.2 mi S of SR 1100	47.3
247	SR 1140	0.2 mi W of SR 1141	39.1

Table 10
Ten Most Structurally Deficient Bridges in McDowell County

<i>Bridge No.</i>	<i>Facility Carried</i>	<i>Location</i>	<i>Rating</i>
13	SR 1135	0.7 mi E of SR 1163	18.7
27	SR 1595	4.0 mi S of US 70	18.2
41	SR 1147	0.2 mi N of SR 1148	15.5
70	SR 1552	0.75 mi N of SR 1586	17.4
175	SR 1150	0.1 mi N of SR 1148	21.6
183	SR 1737	0.05 mi E of NC 226	17.2
238	SR 1506	0.1 mi S of US 221B	20.7
274	SR 1568	0.6 mi N of US 221	19.9
281	SR 1754	0.1 mi N of SR 1804	18.9
304	SR 1407	1.5 mi W of SR 1401	20.0

Of these ten most structurally deficient bridges, the following are included in the current Transportation Improvement Program:

- Bridge No. 41
- Bridge No. 175
- Bridge No. 304
- Bridge No. 70
- Bridge No. 281

Factors Affecting the Future Roadway System

The objective of thoroughfare planning is to develop a transportation system that will meet future travel demand and enable people and goods to travel safely and economically. To determine the needs of an area it is important to understand the role of population, economics, and land use.

Population

The amount of traffic on a section of roadway is a function of the size and location of the population it serves. Investigating past trends in population growth and forecasting future population growth and dispersion is one of the first steps for a transportation planner. Table 11 shows population forecasts for McDowell County. The County was divided into 8 separate zones which consisted of townships with roughly the same types of land use and level of development. The percent growth per year for past years was calculated

using population data from 1940 through 1990. The future percent growth per year for each zone is based on new development currently taking place, proposed development, land availability, transportation access, and land use characteristics.

Table 11
McDowell County Population Forecasts

<i>Zone</i>	<i>Past Trend</i> <i>%/Year</i>	<i>Future Trend</i> <i>%/Year</i>	<i>1990</i> <i>Population</i>	<i>2010</i> <i>Population</i>	<i>2025</i> <i>Population</i>
1	0%	0.1%	1,870	1,910	1,940
2	0%	0.7%	13,728	15,785	17,525
3	3%	0.9%	4,020	4,810	5,500
4	1%	0.3%	4,918	5,225	5,465
5	1%	0.2%	2,300	2,395	2,470
6	3%	0.4%	3,042	3,295	3,498
7	0-1%	0.2%	1,667	1,735	1,790
8	2%	0.6%	4,137	4,665	5,100

KEY for Townships:

Zone 1: North Cove

Zone 2: Marion

Zone 3: Nebo

Zone 4: Old Fort

Zone 5: Crooked Creek

Zone 6: Montford Cove

Zone 7: Glenwood, Brackett

Zone 8: Higgins, Dysartsville

Economy and Employment

One of the more important factors to be considered in estimating the future traffic growth of an area is its economic base. The number of employers and the employee's income or purchasing power influences how much population can be supported in the area and the number of motor vehicles that will be locally owned and operated. Generally, as the family income increases so does the number of vehicles owned, as well as the number of vehicle trips that will be taken each day by a particular household. An accurate projection of the future economy of the area is essential to estimating future travel demand.

Factors which will influence economic growth and development in McDowell County over the 30 year planning period include expansion of the existing hospital, a new regional prison, and a proposed industrial park and County Airport. McDowell County's location and land availability will continue to make it an attractive area for tourism and travel. The easy accessibility to I-40 makes McDowell County attractive for industrial developers, and developers of residential communities will be attracted to the Lake James area which has recently been approved for increased residential development. Increases in residential development will lead to increases in commercial and retail development.

Land Use

Land use refers to the physical patterns of activities and functions within a city or county. Nearly all traffic problems in a given area can attributed in some form to the type of land use. For example, a large industrial plant might be the cause of congestion during shift

change hours as its workers come and go. However, during the remainder of the day few problems, if any, may occur. The spatial distribution of different types of land use is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each.

For use in transportation planning, land uses are grouped into four categories:

1. Residential - all land devoted to the housing of people (excludes hotels and motels)
2. Commercial - all land devoted to retail trade including consumer and business services and offices
3. Industrial - all land devoted to manufacturing, storage, warehousing, and transportation of products
4. Public - all land devoted to social, religious, educational, cultural, and political activities

Anticipated future land use is a logical extension of the present spatial distribution. Determination of where expected growth is to occur within the planning area facilitates the location of proposed thoroughfares or the improvements of existing thoroughfares. Areas of anticipated development and growth in McDowell County include:

1. Residential - central, northeastern
2. Commercial/Retail - central
3. Industrial - central, I-40 corridor, east
4. Public - continued preservation of the Pisgah National Forest, NC Gamelands, and other natural features throughout the County.

The central portion of the County is expected to have the largest growth. This is the area which includes the City of Marion and surrounding areas. Marion has several major routes: US 221, NC 226, I-40, and US 70. Other areas of high growth will likely be south of I-40 on NC 226, north of Marion on US 221, west along US 70, and in the vicinity of Lake James. The slowest growth is expected to occur in the northwestern, southwestern, and northern tip of the County. This slow growth is attributed primarily to the topographic constraints and environmentally sensitive areas.

Forecasted Travel Patterns and Deficiencies

Future Travel Demand

Future travel demand can be forecasted by looking at past traffic trends and calculating the average annual growth rates along any particular route. Average traffic growth in McDowell County ranges from a high of 10% per year to a low of 2% per year. Using these past trends along with projected land uses and forecasted population growth, the

transportation planner is able to forecast future travel demand and to predict where future problems may occur. Figure 4 and Table B-1 in Appendix B provides forecasted traffic for the major and minor thoroughfares in McDowell County.

Capacity Deficient Corridors

Capacity deficient corridors were determined using the volume/capacity ratio (V/C), with the projected traffic over the practical capacity of the facility. A V/C ratio less than one is tolerable. Based on this analysis, several roadways in McDowell County are anticipated to be inadequate by the planning year 2025. These routes are shown in red on Figure 5 and include:

- US 70
- US 221
- NC 226
- SR 1001

Traffic congestion on these routes can be alleviated by widening to increase traffic carrying ability. See Chapter 2 for recommendations.

Streets Approaching Capacity

Analysis indicates that several routes will be approaching capacity by the planning year 2025. These routes are shown in green on Figure 5. Other roadways in the planning area are not expected to have congestion problems within the planning period. However, to improve safety and operating conditions, it is recommended that the roadways designated as either major or minor thoroughfares with lane widths less than 3.66 meter (12-feet) be upgraded to reflect this desired width.

System Deficiencies

System deficiencies result from a lack of a cohesive, continuous, and complimentary major street network. More simply put, a system deficiency exists when drivers must go out of their way to get from point A to point B, or when the path for getting there is not cohesive or continuous. The thoroughfare plan study identified a system deficiency for traffic traveling between I-40 and the Lake James area. A possible means for improving this traffic flow is addressed in Chapter 2. Other system deficiencies that were identified due to substandard design are shown in yellow on Figure 5.

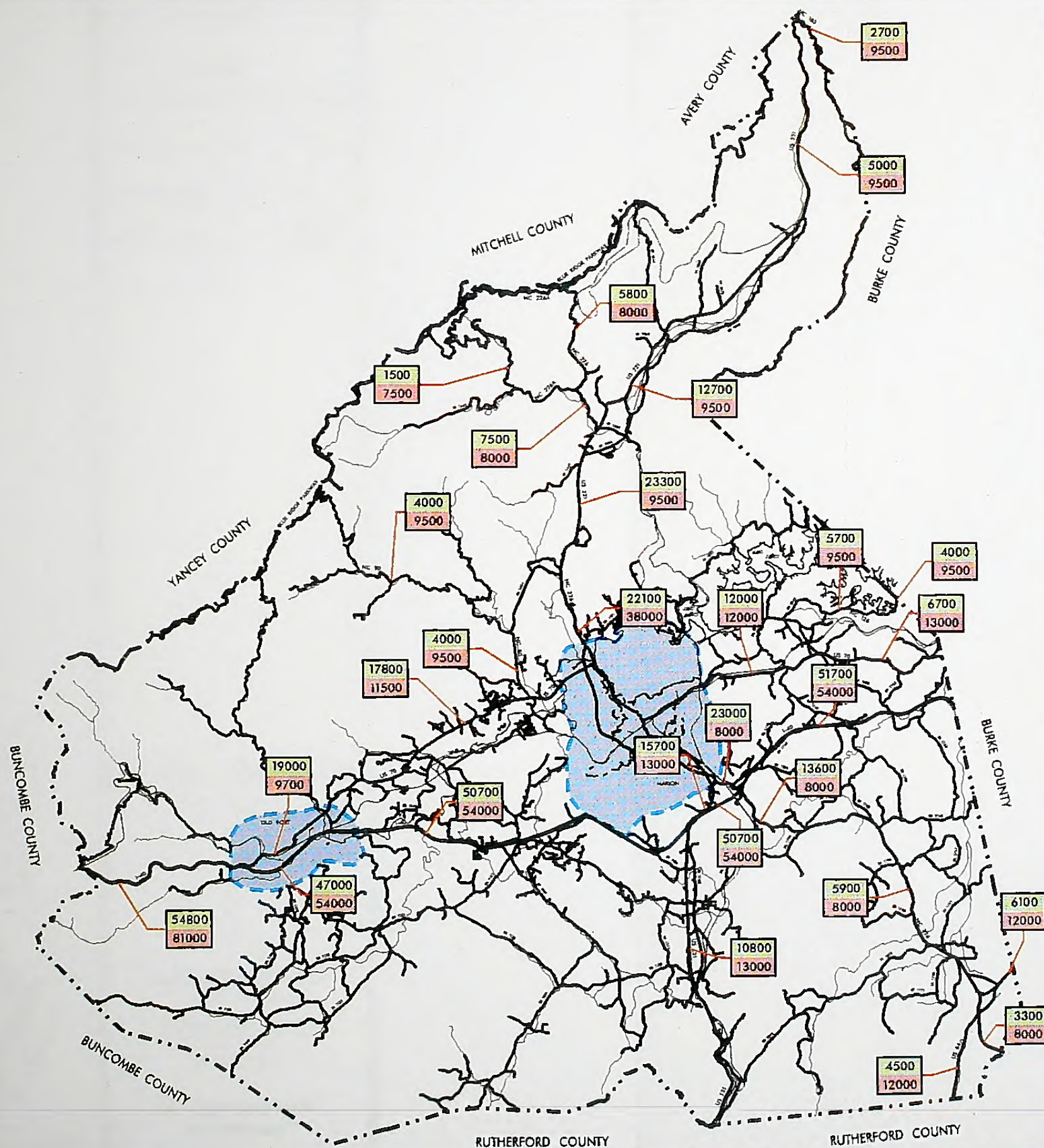
FIGURE 4

LEGEND

2025 Volume
1994 Capacity

99999
99999

Urban Planning Area



2025 TRAFFIC VOLUMES OVER 1994 ROADWAY CAPACITIES



MCDOWELL COUNTY
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FIGURE 5

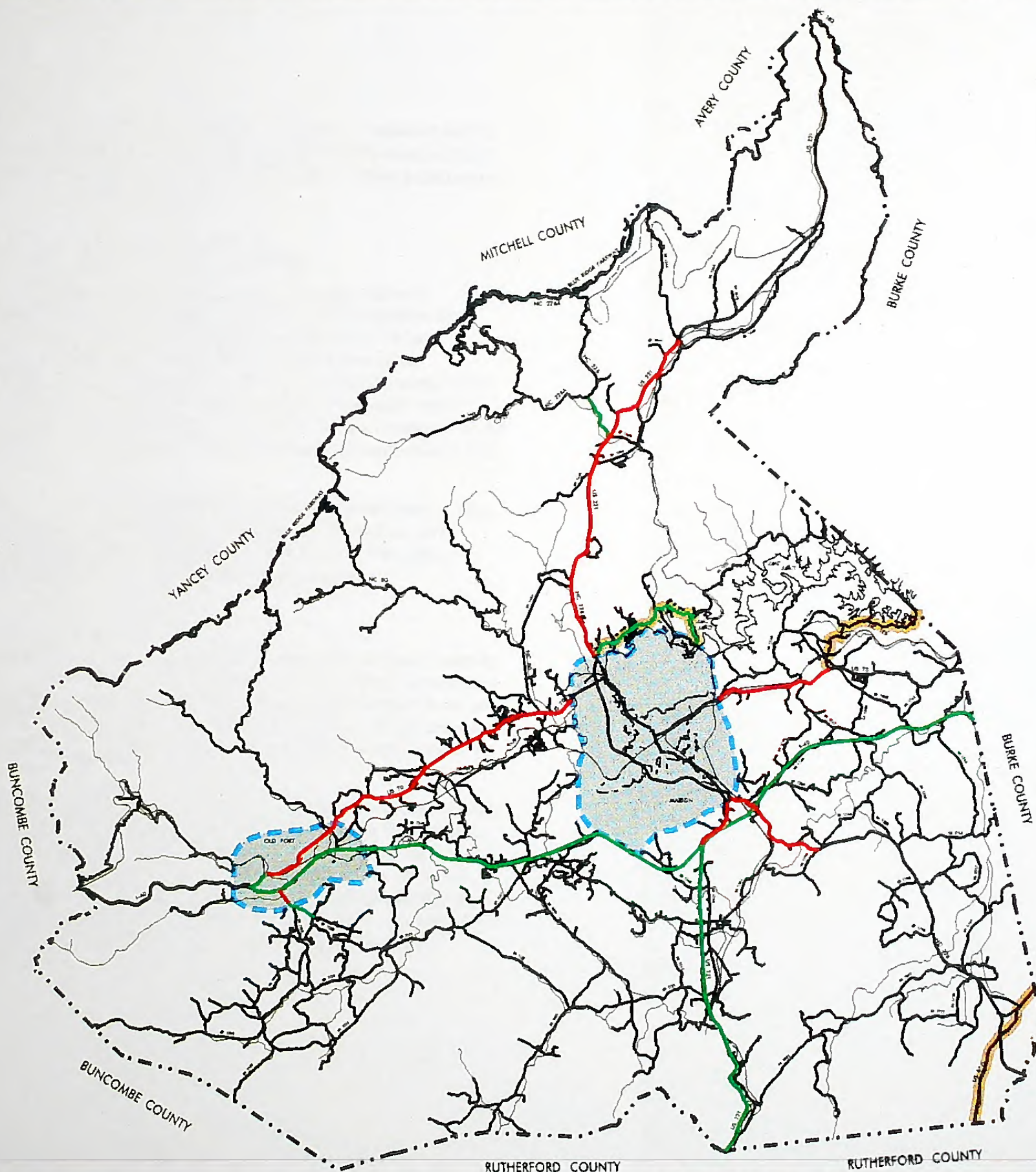
LEGEND

Volume / Capacity = 0.81 - 0.99

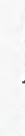
Volume / Capacity > 0.99

Substandard Design

Urban Planning Area



ROADWAY DEFICIENCIES IN 2025



MCDOWELL COUNTY
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Intersection Deficiencies

Problems with intersection design or control can contribute to poor movement of traffic, increased traffic accidents, and driver irritation. Most of the major traffic intersections within McDowell County are located within the Marion Urban Area. These locations are addressed as a part of the Marion Thoroughfare Plan.

Consideration of Environmental Factors

In the past several years, environmental considerations associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the execution of an environmental impact statement (EIS) for road projects that have a significant impact on the environment. The EIS would cover the impact of the project of wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors.

Geographical Information Systems (GIS) mapping was used to identify environmentally sensitive areas in McDowell County and Old Fort. These maps are maintained and updated by the Center for Geographic Information & Analysis (CGIA). This agency receives the information directly from the environmental resource agencies.

Wetlands

In general terms, wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. Water creates severe physiological problems for all plants and animals except those that are adapted for life in it or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by storing nutrients, reducing sediment loads, and reducing erosion. They are also critical to fish and wildlife populations. Wetlands provide an important habitat for about one third of the plant and animal species that are federally listed as threatened or endangered. Utilizing the GIS mapping, it was determined that none of the proposed McDowell County projects will have a major impact on wetlands.

Threatened and Endangered Species

A preliminary review of the Federally Listed Threatened and Endangered Species within McDowell County was done to determine the effects that any proposed improvements could have on these species. The GIS information on threatened and endangered species is provided to CGIA by the North Carolina Department of Environment, Health, and Natural Resources.

The Threatened and Endangered Species Act of 1973 allows the U.S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plant and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we can avoid or minimize these impacts.

There were various Natural Heritage Element occurrences throughout McDowell County. These occurrences are located primarily along the northern portion of US 221 through the Linville area. The NC 226 corridor has two rare plant occurrences. A detailed field investigation of these corridors is recommended prior to the construction of any of these projects.

Historic Sites

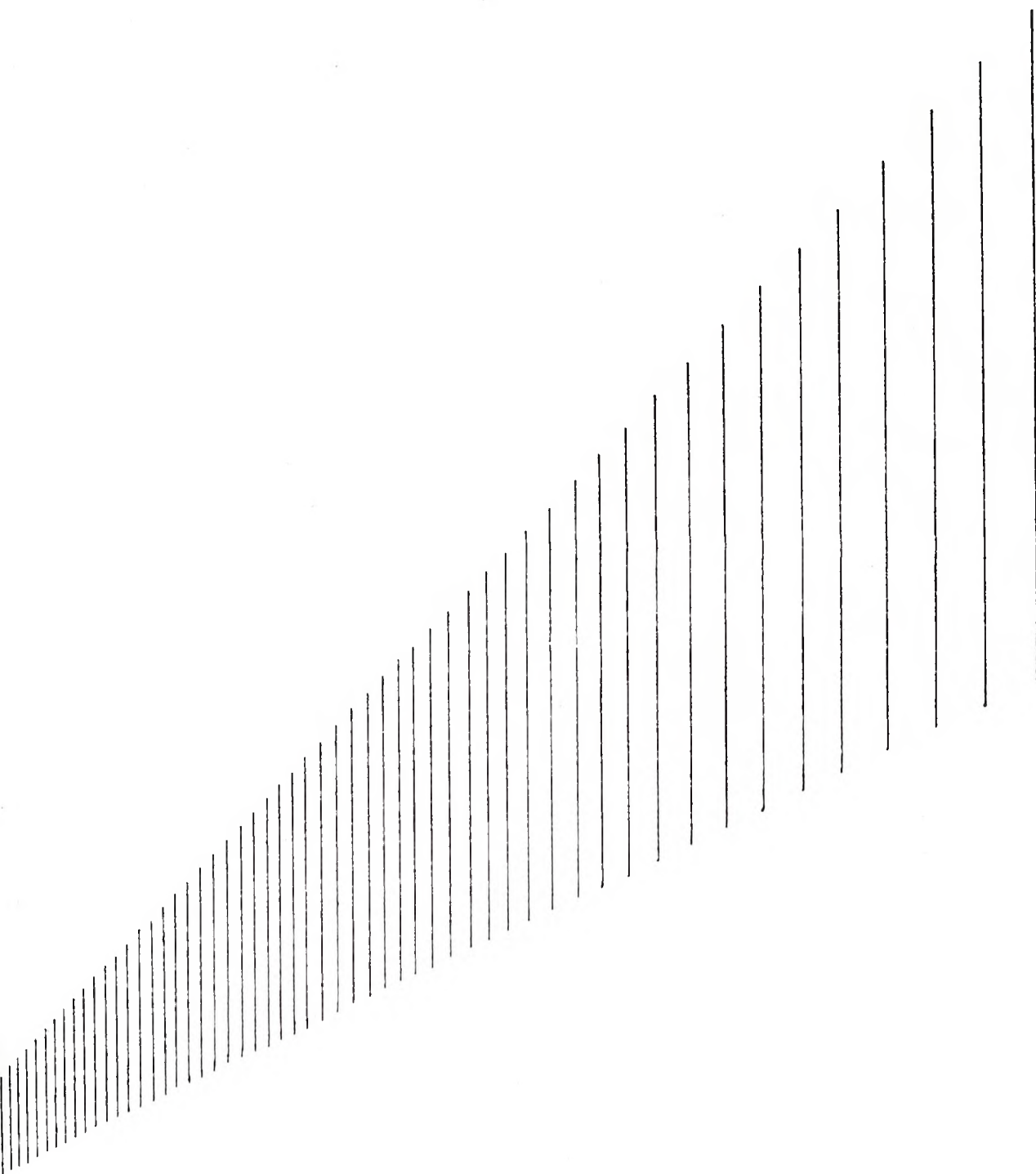
The location of historic sites in McDowell County was investigated to determine the possible impact of the various projects studied. The federal government has issued guidelines requiring all State Transportation Departments to make special efforts to preserve historic sites. In addition, the State of North Carolina has issued its own guidelines for the preservation of historic sites. These two pieces of legislation are described below:

National Historic Preservation Act - Section 106 of this act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The DOT must consider the impact of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

NC General Statute 121-12(a) - This statute requires the DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. DOT must consider impacts and consult with the North Carolina Historical Commission, but it is not bound by their recommendations.

The State Plan for Historic Preservation has several sites listed within McDowell County. Most of these sites are located within Marion and will not be affected by any proposed improvements. One identified property of historic importance, the Carson House, is located on US 70 four miles west of Marion. This property should be given special attention during the proposed US 70 widening project. Other properties were identified within the Old Fort Planning Area, none however that will be impacted by the Old Fort Thoroughfare Plan.

APPENDICES



Appendix A

Thoroughfare Planning Principles

There are many advantages to thoroughfare planning, but the primary mission is to assure that the road system will be progressively developed to serve future travel desires. Thus, the main consideration in thoroughfare planning is to make provisions for street and highway improvements so that, when the need arises, feasible opportunities to make improvements exist.

Benefits of Thoroughfare Planning

There are two major benefits derived from thoroughfare planning. First, each road or highway can be designed to perform a specific function and provide a specific level of service. This permits savings in right-of-way, construction, and maintenance costs. It also protects residential neighborhoods and encourages stability in travel and land use patterns. Second, local officials are informed of future improvements and can incorporate them into planning and policy decisions. This will permit developers to design subdivisions in a non-conflicting manner, direct school and park officials to better locate their facilities, and minimize the damage to property values and community appearance that is sometimes associated with roadway improvements.

County Thoroughfare Planning Concepts

The underlying notion of the thoroughfare plan is to provide a functional system of streets, roads, and highways that permit direct, efficient, and safe travel. Different elements in the system are designed to have specific functions and levels of service, thus minimizing the traffic and land service conflict.

In the county plan, elements are either urban or rural. In the urban planning area, the local municipality generally has planning jurisdiction. Outside the urban planning area, the county has planning jurisdiction. In those urban areas where no urban thoroughfare plan exists, elements are rural and are under the planning jurisdiction of the county.

Within the urban and rural systems, plan elements are classified according to the specific function they are to perform. A discussion of the elements and functions of the two systems follows.

Thoroughfare Classification Systems

Streets perform two primary functions, traffic service and land access, which when combined, are basically incompatible. The conflict is not serious if both traffic and land

service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely developed abutting property lead to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets that permit travel from origins to destinations with directness, ease and safety. Different streets in this system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict.

Urban Classification

In the urban thoroughfare plan, elements are classified as major thoroughfares, minor thoroughfares, or local access streets.

Major Thoroughfares

These routes are the primary traffic arteries of the urban area providing for traffic movements within, around, and through the area.

Minor Thoroughfares

Roadways classified under this type collect traffic from the local access streets and carry it to the major thoroughfare system.

Local Access Streets

This classification covers streets that have a primary purpose of providing access to the abutting property. This classification may be further classified as either residential, commercial and/or industrial depending upon the type of land use that they serve.

Due to the limited amount of detail that can be shown on a county thoroughfare plan, only urban major thoroughfares are shown.

Rural Classification

The facilities outside the urban thoroughfare planning boundaries make up the rural system. There are four major systems: principal arterials, minor arterials, major and minor collectors, and local roads.

Rural Principal Arterial System

This system is a connected network of continuous routes that serve corridor movements having substantial statewide or interstate travel characteristics. This will be shown by both the trip lengths and the travel densities. The principal arterial system should serve all urban areas of over 50,000 population and most of those with a population greater than 5,000. The Interstate system constitutes a significant portion of the principal arterial system.

Figure A-1

RURAL HIGHWAY NETWORK FUNCTIONAL CLASSIFICATION

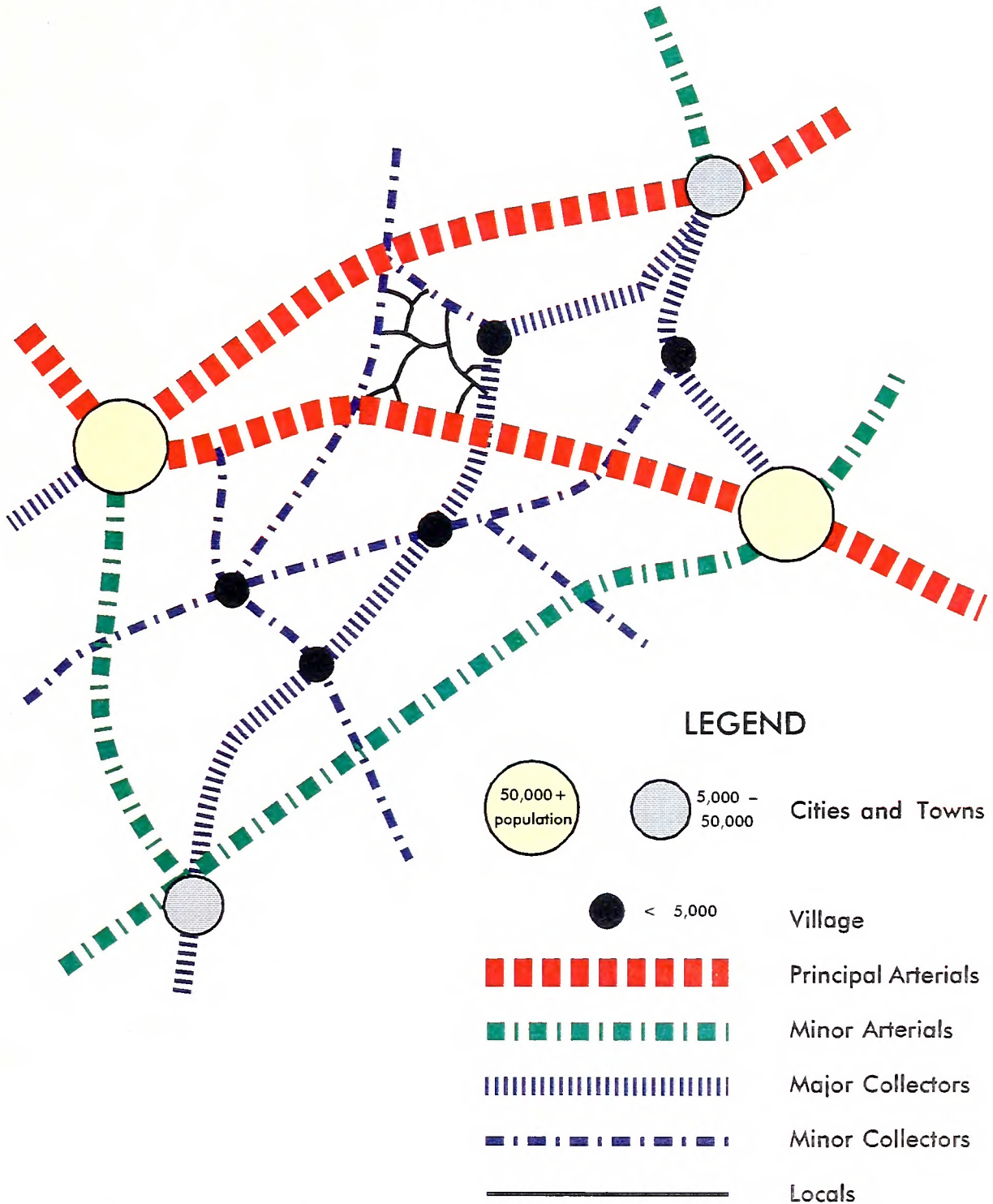








FIGURE A-2

LEGEND

INTERSTATE	
PRINCIPAL ARTERIAL	
MINOR ARTERIAL	
MAJOR COLLECTOR	
MINOR COLLECTOR	
URBAN PLANNING AREA	

FUNCTIONAL
CLASSIFICATION



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Rural Minor Arterial System

This system forms a network that links cities, larger towns, and other major traffic generators such as large resorts. The minor arterial system generally serves intrastate and intercounty travel and travel corridors with trip lengths and travel densities somewhat less than the principal arterial system.

Rural Collector Road System

The rural collector routes generally serve intracounty travel. These routes serve travel whose distances are shorter than on the arterial routes. The rural collector road system is subclassified into major and minor collector roads.

Major Collector Roads

These routes provide service to the larger towns not directly served by the higher systems and to other traffic generators of equivalent intracounty importance, such as consolidated schools, shipping points, county parks, significant mining and agricultural areas, etc. Major collector roads also link these places to routes of higher classification and serve the more important intracounty travel corridors.

Minor Collector Roads

These collect traffic from local roads and bring all developed areas within a reasonable distance of a major collector road. They also provide service to the remaining smaller communities and link the locally important traffic generators with the rural outskirts.

Rural Local Road System

The local roads are all roads that are not on a higher system. Local residential subdivision streets and residential collector streets are elements of the local road system. Local residential streets are either cul-de-sacs, loop streets less than 2,500 feet (762.2 m) in length, or streets less than one mile (1.6 km) in length. They do not connect thoroughfares or serve major traffic generators and do not collect traffic from more than one hundred dwelling units. Residential collectors serve as the connecting street system between local residential streets and the thoroughfare system.

Figure A-1 gives a schematic illustration of a functionally classified rural highway system. The functional classification for McDowell County is shown in Figure A-2.

Objectives of Thoroughfare Planning

Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system to meet the existing and future travel desires within the urban area. The primary aim of a thoroughfare plan is to guide the development of the street system in a manner consistent with changing traffic demands. Through proper planning for street development, costly errors and needless expense can be averted. A thoroughfare plan will enable street improvements to be made as traffic demand increases,

and help eliminate unnecessary improvements. By developing the street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained that will require a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial and industrial enterprises, affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

- To provide for the development of an adequate major street system as land development occurs;
- To reduce travel and transportation costs;
- To reduce the cost of major street improvements to the public through the coordination of street system with private action;
- To enable private interests to plan their actions, improvements, and development with full knowledge of public intent;
- To minimize disruption and displacement of people and businesses through long range planning for major street improvements;
- To reduce environmental impacts such as air pollution, resulting from transportation; and
- To increase travel safety.

These objectives are achieved through improving both the operational efficiency of thoroughfares, and improving the system efficiency by system coordination and layout.

Operational Efficiency

A streets operational efficiency is improved by increasing the capability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a streets capacity is the maximum number of vehicles that can pass a given point on a roadway during a given period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include:

- **Street widening** - widening a street from two to four travel lanes, the capacity of the roadway more than doubles because additional maneuverability for the traffic has been provided
- **Intersection improvements** - increasing the turning radii, adding exclusive turn lanes, and channelizing movements can improve the capacity of an existing intersection

- **Improving vertical and horizontal alignment** - reduces the congestion caused by slow moving vehicles
- **Eliminating roadside obstacles** - reduced side friction and improves a driver's field of sight.

Operational ways to improve street capacity include:

- **Control of access** - a roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number
- **Parking removal** - increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles
- **One-way operation** - the capacity of a street can sometimes be increased 20-50%, depending upon turning movements and street width, by initiating one-way traffic operations. One-way streets also can improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination
- **Reversible lanes** - reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods
- **Signal phasing and coordination** - uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

- **Carpools** - encourage people to form carpools and vanpools for journeys to work and other trip purposes; this reduces the number of vehicles on the roadway and raises the people carrying capability of the street system
- **Alternate mode** - encourage the use of alternate modes of travel such as transit, bicycles, or walking for short distance trips
- **Work hours** - encourage industries, business, and institutions to stagger work hours or establish variable work for employees; this will reduce travel demand in peak periods and spread peak travel over a longer period
- **Land use** - plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means of altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, thoroughfare planning is done for established urban areas and is constrained by existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these and the many other factors that affect major street locations.

Through the thoroughfare planning process it is necessary from a practical viewpoint that certain basic principles be followed as closely as possible. These principles are listed below:

1. The plan should be derived from a thorough knowledge of today's travel - its component parts, and the factors that contribute to it, limit it, and modify it.
2. Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of major traffic movements on a few streets.
3. The plan should conform to and provide for the land development plan for the area.
4. Certain considerations must be given to urban development beyond the current planning period. Particularly in outlying or sparsely developed areas that have development potential, it is necessary to designate thoroughfares on a long-range planning basis to protect rights-of-way for future thoroughfare development.
5. While being consistent with the above principles and realistic in terms of travel trends, the plan must be economically feasible.

Appendix B

Thoroughfare Plan Street Tabulation and Recommendations

This appendix includes a detailed tabulation of all the streets identified as elements of the McDowell County Thoroughfare Plan. The table includes a description of each section, as well as the length, cross-section, and right-of-way for each section. Also included are existing and projected average daily traffic volumes, roadway capacity, and the recommended ultimate lane configuration. Due to space constraints, these recommendations are given in the form of an alphabetic code. A detailed description of each of these alpha-codes and a illustrative figure for each can be found in Appendix C.

The following index of terms may be helpful in interpreting the table:

UPB - Urban Planning Boundary

CL - City Limits

ADQ - Adequate

UNK - Unknown

Co - County

L - lanes

LD - divided lanes

U - indicates an urban sections

Recc - Recommended

Table B-1 Street Tabulation

Street Section	Length		Cross Section		Right-of-way		Avg Daily Traffic		No. of Lanes		Capacity	
	miles	km	feet	meters	ft	meters	1994	2025	Existing	Recc.	Existing	Recc.
I 40												
Buncombe Co. - SR 1407	0.14	0.23	48	14.63	350	106.70	27,000	54,800	6L	ADQ	81,000	81,000
SR 1407 - W Old Fort UPB	4.43	7.15	72	21.95	350	106.70	27,000	46,900	6L	ADQ	81,000	81,000
see Old Fort Tho. Plan	-	-	-	-	-	-	-	-	-	-	-	-
E Old Fort UPB - US 221	10.18	16.42	48	14.63	300	91.50	25,000	50,700	4L	ADQ	54,000	54,000
US 221 - NC 226	1.67	2.69	48	14.63	180	54.90	25,000	50,700	4L	ADQ	54,000	54,000
NC 226 - Burke Co.	6.54	10.55	48	14.63	200	60.98	25,500	51,700	4L	ADQ	54,000	54,000
US 64												
Rutherford Co. - NC 226	2.50	4.03	24	7.32	50	15.24	2,000	4,500	2L	4LD/A	12,000	38,000
NC 226 - Burke Co.	1.46	2.35	24	7.32	50	15.24	2,700	6,100	2L	4LD/A	12,000	38,000
US 70												
see Old Fort Tho. Plan	-	-	-	-	-	-	-	-	-	-	-	-
E Old Ft UPB - W Marion UPB	7.48	12.06	22	6.71	100-60	30.49- 18.29	8,300	17,800	2L	4LD/A	11,500	38,000
see Marion Tho. Plan	-	-	-	-	-	-	-	-	-	-	-	-
E Marion UPB - SR 1536	0.07	0.11	35	10.67	130	39.6	5,600	12,000	2L	2L/K	13,000	13,000
SR 1536 - SR 1537	0.48	0.77	22	6.71	60	18.29	5,600	12,000	2L	2L/K	12,000	13,000
SR 1537 - SR 1826	0.49	0.79	24	7.32	60	18.29	5,600	12,000	2L	ADQ	13,000	13,000
SR 1826 - NC 126	2.17	3.50	22	6.71	60	18.29	5,600	12,000	2L	2L/K	12,000	13,000
NC 126 - Burke Co.	3.93	6.34	24	7.32	60	18.29	3,100	6,700	2L	ADQ	13,000	13,000
US 221												
Rutherford Co. - I 40	8.59	13.85	24	7.32	50	15.24	4,500	10,800	2L	4LD/A	13,000	38,000
I 40 - S Marion UPB	1.62	2.61	24	7.32	50	15.24	6,600	15,700	2L	5LU/C	13,000	35,600
see Marion Tho. Plan	-	-	-	-	-	-	-	-	-	-	-	-
N Marion UPB - US 221 Bus.	0.20	0.32	64	19.51	200	60.98	10,900	22,100	4LD	ADQ	38,000	38,000
US 221 Bus. - NC 226	5.91	9.53	20	6.10	60	18.29	11,500	23,300	2L	4LD/A	9,500	38,000
NC 226 - SR 1566	3.65	5.89	20	6.10	60	18.29	6,600	12,700	2L	2L/K	9,500	13,000
SR 1566 - Avery Co.	10.80	17.42	20	6.10	60	18.29	2,600	5,000	2L	2L/K	9,500	10,500

Table B-1 Street Tabulation

Street Section	Length		Cross Section		Right-of-way		Avg Daily Traffic		No. of Lanes		Capacity	
	miles	km	feet	meters	ft	meters	1994	2025	Existing	Recc.	Existing	Recc.
US 221 Bus. see Marion Tho. Plan												
NC 80												
US 70 - Yancy Co.	12.32	19.87	20-24	6.10- 7.32	60	18.29	2,100	4,000	2L	2L/K	9,500	10,500
NC 126												
US 70 - SR 1595	3.46	5.58	18	5.49	60	18.29	2,400	5,700	2L	2L/K	9,500	10,500
SR 1595 - Burke Co.	0.59	0.95	24	7.32	100	30.49	1,700	4,000	2L	2L/K	9,500	10,500
NC 183												
US 221 - Burke Co.	0.22	0.35	18	5.49	60	18.29	1,200	2,700	2L	2L/K	9,500	10,500
NC 226												
Rutherford Co. - US 64	1.36	2.19	22	6.71	100-60	30.49- 18.29	1,600	3,300	2L	2L/K	8,000	10,500
US 64 - SR 1760	8.17	13.18	22	6.71	100-60	30.49- 18.29	2,900	5,900	2L	2L/K	8,000	10,500
SR 1760 - I 40	2.40	3.87	22	6.71	100-60	30.49- 18.29	5,700	13,600	2L	4LD/A	8,000	38,000
I 40 - Marion UPB	0.89	1.44	22	6.71	100-60	30.49- 18.29	11,700	23,000	2L	5LU/C	8,000	35,600
common US 221 (Marion TP)	-	-	-	-	-	-	-	-	-	-	-	-
US 221 - NC 226 Alt	1.35	2.18	21	6.40	40	12.19	4,100	7,500	2L	2L/K	8,000	10,500
NC 226 Alt - Mitchel Co.	4.18	6.74	20-21	6.10- 6.40	50	15.24	3,200	5,800	2L	2L/K	8,000	10,500
NC 226 Alt												
NC 226 - Mitchel Co.	12.21	19.69	18-20	5.49- 6.10	60	18.29	800	1,500	2L	2L/K	7,500	10,500

Table B-1 Street Tabulation

Street Section	Length		Cross Section		Right-of-way		Avg Daily Traffic		No. of Lanes		Capacity	
	miles	km	feet	meters	ft	meters	1994	2025	Existing	Recc.	Existing	Recc.
SR 1001 Rutherford Co. - I 40	10.64	17.16	18-24	5.49- 7.32	UNK	UNK	3,200	6,100	2L	2L/K	10,500	10,500
I 40 - S Marion UPB see Marion Tho. Plan	0.15	0.24	22	6.71	UNK	UNK	7,500	15,200	2L	5LU/C	9,500	35,600
SR 1135 SR 1103 - SR1137	5.30	8.55	24	7.32	60	18.29	600	1,100	2L	ADQ	10,500	10,500
SR 1137 - US 221	7.60	12.26	18-20	5.49- 6.10	UNK	UNK	600	1,100	2L	2L/K	8,000	10,500
SR 1137 SR 1135 - SR 1001	3.19	5.15	16	4.88	UNK	UNK	1,600	3,000	2L	2L/K	7,000	10,500
SR 1168 Marion UPB - US 221	1.80	2.90	18	5.49	UNK	UNK	2,100	4,000	2L	2L/K	7,500	10,500
SR 1191 SR 1137 - I 40	0.08	0.13	18	5.49	60	18.29	1,200	2,300	2L	2L/K	7,500	10,500
I 40 - Marion UPB	1.51	2.44	18	5.49	60	18.29	1,300	2,500	2L	2L/K	7,500	10,500
SR 1434 NC 221 - NC 80	2.70	4.35	20	6.10	UNK	UNK	1,500	3,000	2L	2L/K	8,000	10,500
SR 1501 SR 1500 - Garden St	7.51	12.11	18-24	5.49- 7.32	UNK	UNK	1,000	2,700	2L	2L/K	10,500	13,000
Garden St - US 221 Bus.	0.03	0.05	24	7.32	UNK	UNK	3,800	10,000	2L	2L/K	10,500	13,000
SR 1536 US 70 E - US 70 W	4.30	6.94	18-20	5.49-	UNK	UNK	2,800	5,700	2L	2L/K	8,000	10,500

Table B-1 Street Tabulation

Street Section	Length		Cross Section		Right-of-way		Avg Daily Traffic		No. of Lanes		Capacity	
	miles	km	feet	meters	ft	meters	1994	2025	Existing	Recc.	Existing	Recc.
				6.10								
SR 1741												
NC 226 - I 40	2.62	4.23	18	5.49	UNK	UNK	2,400	4,800	2L	2L/K	8,500	10,500
I 40 - SR 1747	0.56	0.90	18	5.49	UNK	UNK	900	1,800	2L	2L/K	7,500	10,500
SR 1747												
US 70 - SR 1760	2.23	3.60	18-22	5.49-6.71	UNK	UNK	3,000	6,000	2L	2L/K	8,000	10,500
SR 1760												
NC 226 - US 70	6.85	11.05	18-20	5.49-6.10	UNK	UNK	1,600	3,200	2L	2L/K	8,000	10,500
SR 1764												
Burke Co. - NC 226	3.10	5.00	18	5.49	UNK	UNK	700	1,400	2L	2L/K	7,500	10,500
SR 1781												
US 221 - US 221 N	3.20	5.16	18	5.49	UNK	UNK	400	850	2L	2L/K	7,500	10,500
SR 1786												
US 221 S - US 221 N	3.85	6.21	18	5.49	UNK	UNK	1,200	2,500	2L	2L/K	7,500	10,500
SR 1802												
NC 226 - SR 1781	7.00	11.29	18	5.49	UNK	UNK	200	450	2L	2L/K	7,500	10,500

Appendix C

Typical Cross Sections

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way. Typical cross sections recommended by the Statewide Planning Branch are shown in Figure C-1. These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross sections should be developed that meet the needs of the project.

The recommended typical cross sections shown in Appendix B, Table B-1 were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate right-of-way should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed in Appendix B. Recommendations for "ultimate" cross sections are provided for the following:

1. thoroughfares which may require widening after the current planning period
2. thoroughfares which are borderline adequate and accelerated traffic growth could render them deficient
3. thoroughfares where an urban curb and gutter cross section may be locally desirable because of urban development or redevelopment

Recommended design standards relating to grades, sight distances, degree of curve, super elevation, and other considerations for thoroughfares are given in Appendix D.

A - Four Lanes Divided with Median - Freeway

Typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 14 m (46 feet), but a wider median is desirable.

B - Seven Lanes - Curb & Gutter

This cross section is not recommended for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as when widening from a five lane section and right-of-way is

limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "D" is the final cross section.

C - Five Lanes - Curb & Gutter

Typical for major thoroughfares, this cross section is desirable where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

D - Six Lanes Divided with Raised Median - Curb & Gutter / E - Four Lanes Divided with Raised Median - Curb & Gutter

These cross sections are typically used on major thoroughfares where left turns and intersection streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16 ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

F - Four Lanes Divided - Boulevard, Grass Median

Recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

G - Four Lanes - Curb & Gutter

This cross section is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

H - Three Lanes - Curb & Gutter

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "H".

I - Two Lanes - C&G, Parking both sides ; J - Two Lanes - C&G, Parking one side

Cross sections "I" and "J" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "I" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

K - Two Lanes - Paved Shoulder

This cross section is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m. In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m will be preserved by use of building setbacks and future street line ordinances.

L - Six Lanes Divided with Grass Median - Freeway

Cross section "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

M - Eight Lanes Divided with Raised Median - Curb & Gutter

Also used for controlled access freeways, this cross sections may be recommended for freeways going through major urban areas or for routes projected to carry very high volumes of traffic.

N - Five Lanes/C&G, Widened Curb Lanes ; O - Two Lane/Shoulder Section; P - Four Lanes Divided/Raised Median, C&G, Widened Curb Lanes

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. Cross sections "N", "O", and "P" are typically used to accommodate bicycle travel.

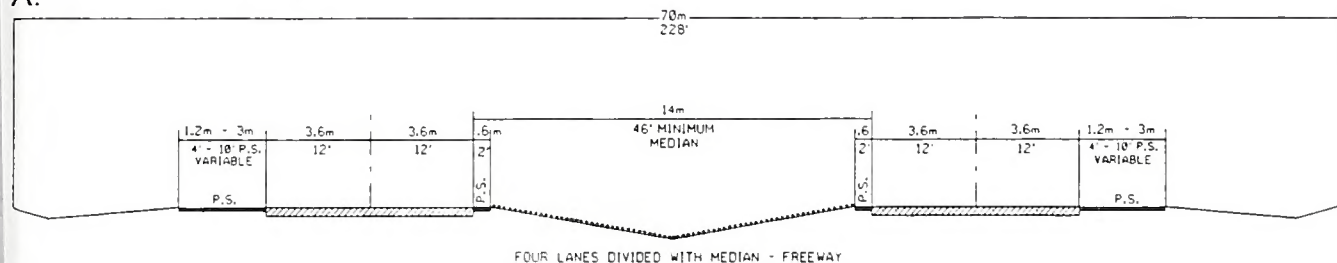
General

The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

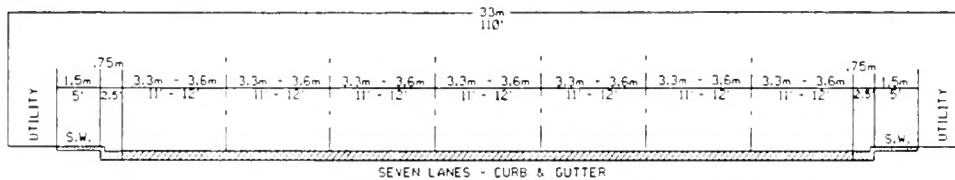
The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

TYPICAL THOROUGHFARE CROSS SECTIONS

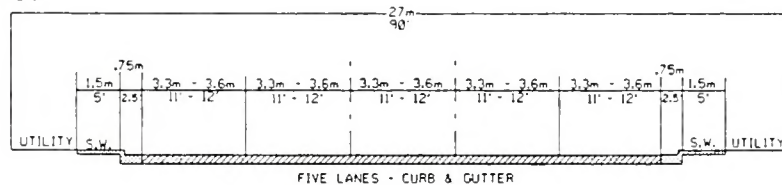
A.



B.



C.



D.

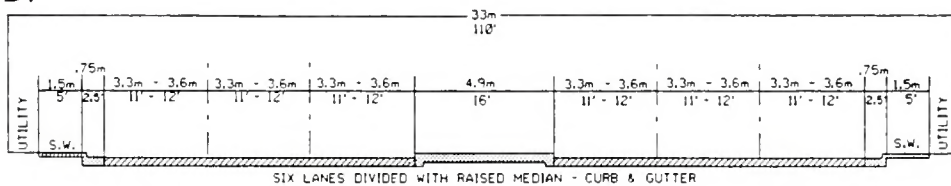
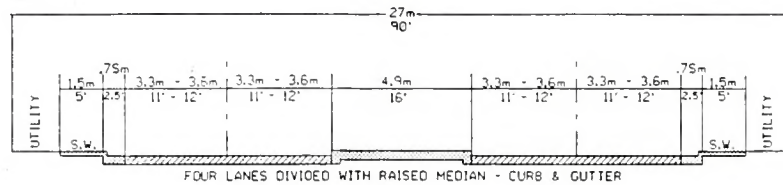


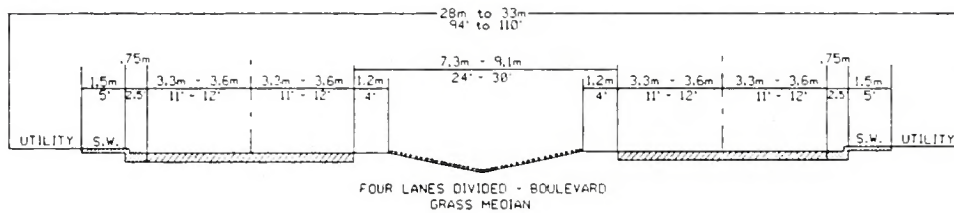
FIGURE C-1

TYPICAL THOROUGHFARE CROSS SECTIONS

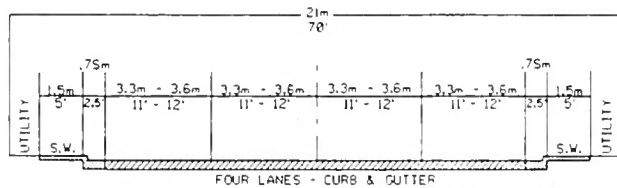
E.



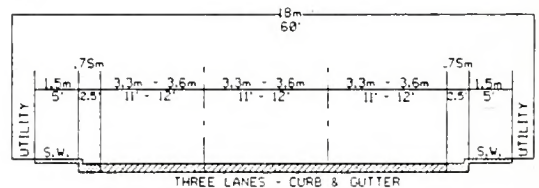
F.



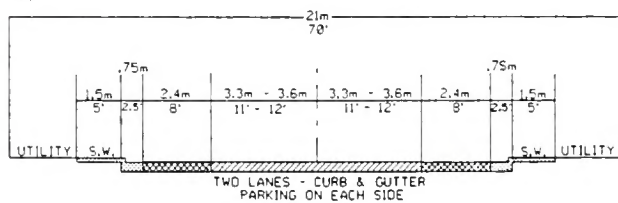
G.



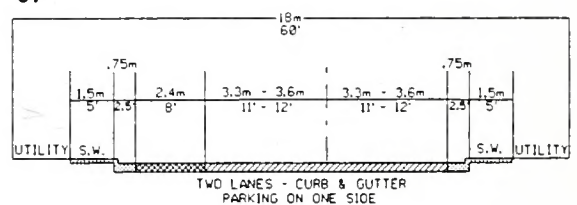
H.



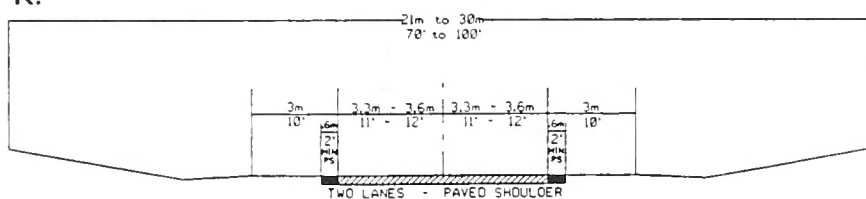
I.



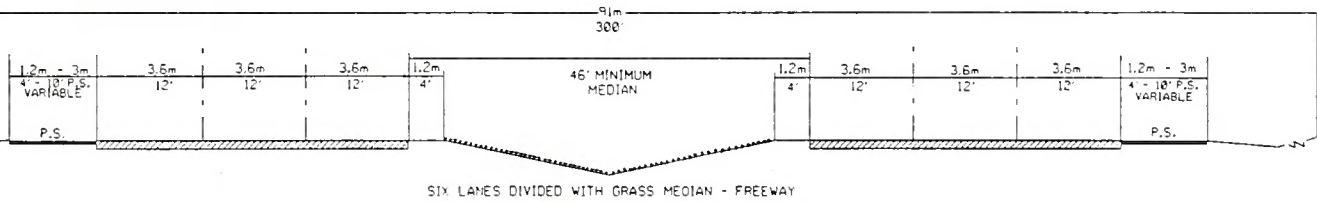
J.



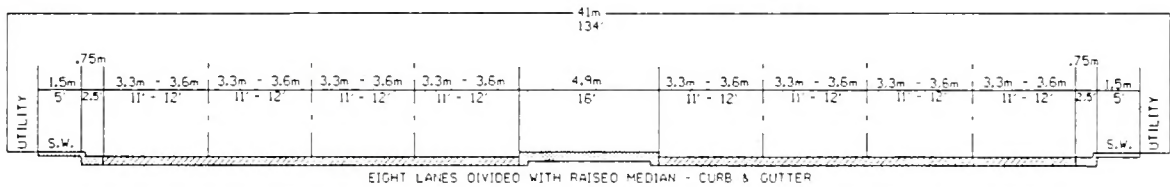
K.



TYPICAL THOROUGHFARE CROSS SECTIONS

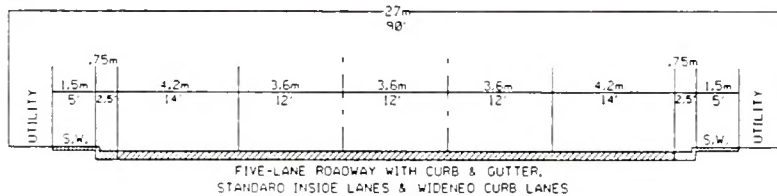


M.

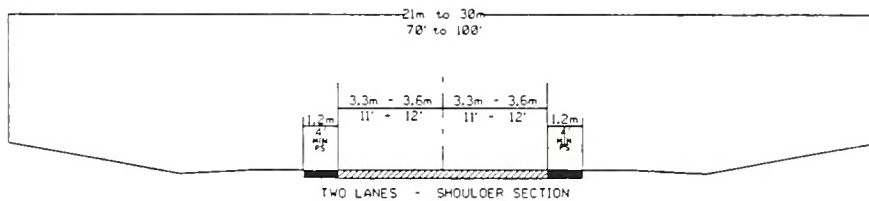


TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

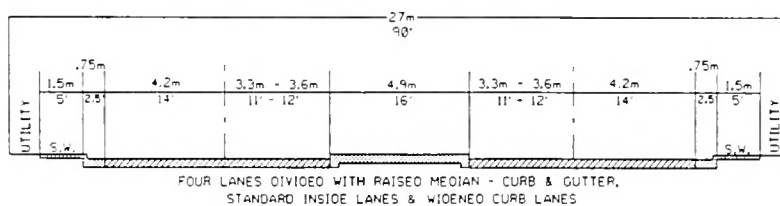
N.



O.



P.



Appendix D

Recommended Subdivision Ordinances

Definitions

Streets and Roads

Rural Roads

1. *Principal Arterial* - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.
2. *Minor Arterial* - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.
3. *Major Collector* - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.
4. *Minor Collector* - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.
5. *Local Road* - A road which serves primarily to provide access to adjacent land, over relatively short distances.

Urban Streets

1. *Major Thoroughfares* - Major thoroughfares consist of Inter-state, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.
2. *Minor Thoroughfares* - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.
3. *Local Street* - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

Specific Type Rural or Urban Streets

1. *Freeway, expressway, or parkway* - Divided multilane roadways designed to carry large volumes of traffic at this speeds. A *freeway* provides for continuous flow of

vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An *expressway* is a facility with full or partial control of access and generally with grade separations at major intersections. A *parkway* is for non-commercial traffic, with full or partial control of access.

2. *Residential Collector Street* - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.
3. *Local Residential Street* - Cul-de-sacs, loop streets less than 750 meters in length, or streets less than 1.5 kilometers in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.
4. *Cul-de-sac* - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn around provided.
5. *Frontage Road* - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.
6. *Alley* - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

Property

Building Setback Line

A line parallel to the street in front of which no structure shall be erected.

Easement

A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

Lot

A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. (Also includes "plat" and "parcel").

Subdivision

Subdivider

Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

Subdivision

All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets.

The following shall not be included within this definition nor subject to these regulations:

- The combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein
- the division of land into parcels greater than four hectares where no street right-of-way dedication is involved
- the public acquisition, by purchase, of strips of land for the widening or the opening of streets
- the division of a tract in single ownership whose entire area is no greater than 0.8 hectares into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

Dedication

A gift, by the owner, of his property to another party without any compensation being given for the transfer. The dedication is made by written instrument and completed with an acceptance.

Reservation

Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

Design Standards

Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted. The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

Right-of-way Widths

Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

Table D-1
Minimum Right-of-way Requirements

<i>Area Classification</i>	<i>Functional Classification</i>	<i>Minimum ROW</i>
RURAL	Principle Arterial	Freeways -105 meters and Other - 60 meters
	Minor Arterial	30 meters
	Major Collector	30 meters
	Minor Collector	24 meters
	Local Road	18 meters ¹
URBAN	Major Thoroughfare	27 meters
	Minor Thoroughfare	21 meters
	Local Street	18 meters ¹
	Cul-de-sac	variable ²

¹ The desirable minimum right-of-way (ROW) is 18 meters. If curb and gutter is provided, 15 meters of ROW is adequate on local residential streets.

² The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

The subdivider will only be required to dedicate a maximum of 30 meters of ROW. In cases where over 30 meters of ROW is desired, the subdivider will be required only to reserve the amount in excess of 30 meters. On all cases in which ROW is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width ROW, not less than eighteen meters in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required ROW shall be dedicated.

Street Widths

Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. *Local Residential*

- Curb and Gutter section
 - 7.8 meters, face to face of curb
- Shoulder section
 - 6 meters to edge of pavement, 1.2 meters for shoulders

2. *Residential Collector*

- Curb and Gutter section
 - 10.2 meters, face to face of curb
- Shoulder section
 - 6 meters to edge of pavement, 1.8 meters for shoulders

Geometric Characteristics

The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. *Design Speed* - The design speed for a roadway should be a minimum of 10 km/h greater than the posted speed limit. The design speeds for subdivision type streets are shown in Table D-2.
2. *Minimum Sight Distance* - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the parameters set forth in Table D-3.
3. *Maximum and Minimum Grades*
 - the maximum grades in percent are shown in Table D-4
 - minimum grade should not be less than 0.5%
 - grades for 30 meters each way from intersections (measured from edge of pavement) should not exceed 5%
4. *Superelevation* - Table D-5 shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

Table D-2
Design Speeds

<i>Facility Type</i>	<i>Desirable(km/h)</i>	<i>Minimum(km/h)</i>	
		<i>Level</i>	<i>Rolling</i>
Rural			
Minor Collector Roads	100	80	70
Local Roads	80	80	70
Urban			
Major Thoroughfares	100	80	80
Minor Thoroughfares	100	80	70
Local Streets	70	70	50

Table D-5
Sight Distance

<i>Design Speed (km/h)</i>	<i>Stopping Sight Distance (meters)</i>		<i>Minimum K¹ Value</i>	
	<i>Minimum</i>	<i>Desirable</i>	<i>Crest Curve</i>	<i>Sag Curve</i>
30	30	30	3	4
50	60	70	10	12
60	80	90	18	18
90	140	170	71	40
100	160	210	105	51

^{NOTE:} General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.

¹K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "AASHTO, 1990".

Table D-4
Maximum Vertical Grade

<i>Facility Type and Design Speed (km/h)</i>	<i>Maximum Grade in Percent</i>		
	<i>Flat</i>	<i>Rolling</i>	<i>Mountainous</i>
Rural			
Minor Collector ¹			
30	7	10	12
50	7	9	10
60	7	8	10
90	6	7	9
100	5	6	8
110	4	5	6
Local Roads ¹			
30	-	11	16
50	7	10	14
60	7	9	12
90	6	8	10
100	5	6	-
Urban			
Major Thoroughfares			
50	8	9	11
60	7	8	10
90	6	7	9
100	5	6	8
Minor Thoroughfares ¹			
30	9	10	12
50	9	9	10
60	9	8	10
90	7	7	9
100	6	6	8
110	5	5	6
Local Streets ¹			
90	-	12	17
30	8	11	15
50	8	10	13
60	7	9	11
100	6	7	-

¹ For streets and roads with projected annual average daily traffic less than 250 or short steep grades less than 150 meters long, grades may be 2% steeper than the values in the table.

**Table D-5
Superelevation**

<i>Design Speed (km/h)</i>	<i>Minimum Radius at Maximum e^1</i>		
	<i>$e=0.04$</i>	<i>$e=0.06$</i>	<i>$e=0.08$</i>
50	100	90	80
60	150	135	125
90	375	335	305
100	490	435	395

¹ e = rate of roadway superelevation, meter per meter

Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixth-five degrees.
2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.
3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters between survey centerlines.

Cul-de-sacs

Cul-de-sacs shall not be more than one hundred and fifty (150) meters in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.
2. The width of an alley shall be at least six (6) meters.
3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the dead-end as may be required by the Planning Board.

Permits for Connection to State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

Offsets to Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9 meters from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters from the face of curb.

Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:
 - shoulder section approach
 - under 800 ADT design year - minimum 8.4 meters width face to face of parapets, rails, or pavement width plus 3 meters, whichever is greater
 - 800 - 2000 ADT design year - minimum 10.2 meters width face to face of parapets, rails, or pavement width plus 3.6 meters, whichever is greater
 - over 2000 ADT design year - minimum width of 12 meters, desirable width of 13.2 meters width face to face of parapets or rails
 - curb and gutter approach
 - under 800 ADT design year - minimum 7.2 meters face to face of curbs
 - over 800 ADT design year - width of approach pavement measured face to face of curbs
 - where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters, or greater if sidewalks are required
2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

- shoulder section approach - width of approach pavement plus width of usable shoulders on the approach left and right (shoulder width 2.4 m minimum, 3 m desirable)
- curb and gutter approach - width of approach pavement measured face to face of curbs

Metric Units

The following tables will be helpful to the reader in making conversions from the metric system into English units.

Table D-6
Metric Conversion Table

<i>English Units</i>	<i>Metric Units</i>	<i>Abbreviation</i>
1 inch	25 millimeters	mm
1 foot	0.3 meters	m
1 mile	1.6 kilometers	km
1 acre	2.47 hectares	hect

Table D-7
Metric Measurement Equivalents

<i>Standard</i>	<i>Equivalent</i>
1 millimeter	0.001 meters
1 kilometer	1000 meters
1 hectare	10,000 square meters

Appendix E

Index for Secondary Road Numbers

- SR 1001 - Sugar Mill Rd
- SR 1103 - Catawba Ave
- SR 1135 - Old Fort/Sugar Hill
- SR 1137 - Zion Hill Church Rd
- SR 1168 - Ashworth Rd
- SR 1191 - Veterans Dr
- SR 1407 - Mill Creek Rd
- SR 1434 - Toms Creek Rd
- SR 1500 - Fleming Ave
- SR 1501 - Hankins Rd
- SR 1536 - Memorial Park Rd
- SR 1537 - Beaman St
- SR 1566 - Peppers Creek Rd
- SR 1741 - Fairview Rd
- SR 1747 - Harmony Grove Rd
- SR 1760 - Harmony Grove Rd
- SR 1764 - Pinnacle Church Rd
- SR 1781 - Polly Spout Rd
- SR 1786 - Old US 221
- SR 1802 - Vein Mountain Rd

Appendix F

Old Fort Thoroughfare Plan Recommendations

As part of the McDowell County Thoroughfare Plan study, a thoroughfare plan study for Old Fort was also completed. This study utilized the same principles and procedures outlined in the main body of this report. The results of this study are outlined in this Appendix. Also contained at the end of this Appendix is a detailed tabulation of all the streets identified as elements of the Old Fort Thoroughfare Plan. This table is similar to the one contained in Appendix B and therefore the same definitions and figures from Appendix B and C apply.

Capacity Deficiencies

Past trends in population and traffic volumes were used to identify the deficient routes. Existing and projected traffic volumes along with the existing capacities are shown on Figure F-1. Table F-1 below shows the projected growth for Old Fort and the surrounding area.

Table F-1
Projected Growth

	<i>1990 Population</i>	<i>2010 Population</i>	<i>2025 Population</i>
Town of Old Fort	732	1,150	1,325
Old Fort Township	4,918	5,222	5,462
Planning Area	985	1,400	1,600

Base Year

The following routes were identified as approaching capacity in the base year:

- US 70 from Spring Street to Red Town Road

Future Year

The following routes were identified as either having capacity deficiencies or as approaching capacity by the design year (2025):

Over Capacity

- US 70 from WCL Old Fort to the eastern UPB
- Catawba Avenue from Sugar Hill Road to I-40

Approaching Capacity

- US 70 from I-40 to WCL Old Fort
- Catawba Avenue from UPB to Sugar Hill Road

System Deficiencies

System deficiencies result from a lack of a cohesive, continuous, and complimentary major street network. The thoroughfare plan study for Old Fort identified a number of system deficiencies in and around the Old Fort Planning Area. These deficiencies are listed below:

- no adequate connection between Catawba Avenue (SR 1103) and Lackeytown Road (SR1235)
- Catawba River Road (SR 1274) is connected to the I-40 eastbound off ramp
- the Railroad crossing from the industrial development along South Railroad Street to US 70 is narrow and inadequate
- existing alignment for Oakdale Road (SR 1234) is circuitous and inefficient
- there is no access for US 70 from I-40 west, or to I-40 east from west of Old Fort
- there currently exists no north - south grade separation for the RR tracks running through Old Fort

Recommendations:

Please see Figure F-2 for a copy of the Old Fort Thoroughfare Plan.

Updates to the 1968 Thoroughfare Plan

A thoroughfare plan was adopted by the Town of Old Fort in 1968. This thoroughfare plan identified the major and minor thoroughfares for the Town of Old Fort. To keep with the changing nature of travel, it is recommended that the following routes be changed from major to minor thoroughfares:

- Bat Cave Road (SR 1103) from Sugar Hill Road (SR 1135) to Planning Boundary

- Lackeytown Road (SR 1235)
- Oakdale Road (SR 1234)
- Greenlee Road (SR 1246)
- Curtis Creek Road (SR 1240)

The following routes and /or recommendations were identified on the 1968 Thoroughfare Plan and are recommended for removal from the 1995 Thoroughfare Plan:

- Old US 70 (SR 1407), omit as a major thoroughfare
- Catawba River Road intersection with I-40 ramp, omit recommendation to realign Catawba River Road per a study conducted by NCDOT Division 13

The proposals listed below were identified on the 1968 Thoroughfare Plan. The 1995 Thoroughfare Plan Study recommends retaining these proposals as part of the 1995 Old Fort Thoroughfare Plan.

- Southern Connector, provide a connector route between Bat Cave Road (SR 1103) and Lackeytown Road (SR 1274)
- Oakdale Road (SR 1234), realign Oakdale Road to provide a more direct route between Lackeytown Road and Curtis Creek Road (SR 1240)
- Improve Lackeytown Road crossing over the RR tracks and intersection with US 70

New Recommendations

The following recommendations are based on the findings of the 1995 Old Fort Thoroughfare Plan study. These recommendations are based on forecasted traffic volumes, population growth, and land use development.

US 70

This facility provides a parallel route to I-40 and serves as a connector between Old Fort and Marion. Although there is some regional traffic that uses this route, most of the trips on this roadway are local. The Old Fort community provides a pocket of industrial development supplying many jobs for the residents of McDowell County. US 70 is the main route for work trips originating in Marion and Pleasant Gardens traveling to the work sites in Old Fort.

Within Old Fort, US 70 provides land access to commercial and retail establishments. This route also carries traffic from the industrial sites east of Old Fort to I-40 west. Currently US 70 within the Old Fort Planning Area is a 2-lane cross-section with parking in limited areas. It is estimated that by the design year 2025, traffic operations on US 70 will decline due to increases in traffic volumes. To maintain safety and efficiency, it is recommend that US 70 be upgraded to provide a 24-foot cross-section with paved shoulders from I-40 to Spring Street. To accommodate left turns, a 3-lane urban section

is recommended from Spring Street to Red Town Road. From Red Town Road to the eastern planning boundary, a 4-lane section is recommended to accommodate through traffic and work trips to the industrial areas east of Old Fort.

Catawba Avenue (SR 1103)

Also known as Bat Cave Road south of I-40, Catawba Avenue provides access to Old Fort from residential development to the south. Development along Catawba Avenue within the planning area is primarily commercial and retail. An interchange with I-40 providing easy access to and from the interstate makes this area an attractive location for this type of development. Since commercial expansion on Catawba Avenue north of I-40 will be somewhat limited, it is likely that development in this area will begin to occur south of the interchange. This growth along with increases in through traffic will push traffic volumes on Catawba Avenue beyond the capacity that the roadway is currently designed for. It is recommended that Catawba Avenue from I-40 to Sugar Hill Road be widened to a 4-lane urban section to better handle increased traffic volumes and turning movements.

Other Requests Investigated

Construction of Westbound Off-ramp and Eastbound On-ramp for I-40 and US 70 Interchange west of Old Fort

This request was field investigated and discussed with the Division Engineer. Based on the land use in this area and the limited growth potential due to topographic constraints and the boundary of the Pisgah National Forest, the North Carolina Department of Transportation cannot recommend pursuing this improvement at this time. The cost of redesigning and constructing this interchange would far outweigh any benefits that would be gained.

Grade Separation of Railroad

An active line of the Southern Railway Company runs through the north end of Old Fort. This rail line travels west from Marion and then from Old Fort travels to the north into Graphite and then continues west towards Asheville. Several major roadways in the Old Fort Planning Area cross this rail line. These routes include: US 70, Catawba Avenue (SR 1103), Lackeytown Road (SR 1235), and Greenlee Road (SR 1246). The rail crossing at US 70, an east-west facility, is the only location in Old Fort which is grade separated. The Town of Old Fort requested that the feasibility of providing an additional grade separated crossing for one of the north-south routes be investigated.

After a field review and discussions with the Division Engineer, it was determined that providing an additional grade separation for the rail line is not feasible. Bridging the railroad at any of the three major north-south routes is prohibitive due to construction costs and the impact to the surrounding area. A grade separated crossing on Catawba Avenue would require irreparable damage to the business community in Old Fort. In addition, this location is physically constrained due to the closeness of the existing rail line to US 70. This same situation exists at the crossing on Lackeytown Road. Although the crossing on Greenlee Road is farther away from US 70, the rail line at this location is

parallel to I-40 making it difficult, if not impossible to bridge either the rail line or Greenlee Road.

A signalized crossing was recently installed at the Catawba Avenue rail crossing. Catawba Avenue is second only to US 70 in the volume of traffic carried in Old Fort. The construction of the signalized crossing at this location will provide a high level of safety for travelers in and through Old Fort.

Additional Concerns Expressed by Town Board

The following additional concerns were expressed by the Old Fort Town Board and fall outside of the scope of the Thoroughfare Plan. A request was made to the Division 13 office to provide further study and/or guidance on the following:

Emergency Signal at US 70 and Spring Street

The Town Board requests that the possibility of installing an emergency signal at the intersection of US 70 and Spring Street be investigated. This signal would be activated during the event of an emergency to allow emergency vehicles to better access US 70.

Railroad Crossing on Curtis Creek Road

Investigate the possibility of installing advance warning signs alerting motorists to the possibility of stopped vehicles at the RR crossing. Concern was expressed that motorists traveling from the I-40 interchange towards US 70 may not be alert to stopped vehicles around the blind curve on Curtis Creek Road, increasing the potential for accidents.

Public Involvement

The Old Fort Thoroughfare Plan study was officially started in August of 1994. On June 19, 1995, preliminary findings were presented to the Town Board. On August 17, 1995, a public drop-in session was held to discuss the findings of the study with members of the public on a one-to-one basis. Several citizens attended and had general questions and comments. The Public Hearing was held on August 21, 1995. Members of the public were present, and comments were received. The Old Fort Town Board adopted the Thoroughfare Plan at this meeting. The Plan was adopted by the North Carolina Board of Transportation on October 6, 1995.

Construction Priorities and Cost Estimates

The potential cost estimate for the major transportation projects on the Old Fort Thoroughfare Plan are given in Table F-2. The evaluation for each project accounts for the user benefits, the probability that economic development will be stimulated and the probability that environmental impacts will be minimized. For a more detailed description of how these values are determined, please refer to Chapter 3 - Implementation of the Thoroughfare Plan.

Table F-2
Benefits Evaluation for Major Projects

<i>Project</i>	<i>Benefits (millions)</i>	<i>Cost* (millions)</i>	<i>Length (km)</i>	<i>Benefits/ km</i>	<i>Economic Develpmnt.</i>	<i>Envirn. Impact</i>
US 70 Widening	85.2	4.4	2.4	35.5	0.4	+0.3/-0.2
Catawba Avenue Widening	30.3	2.0	0.9	30.3	0.4	+0.2/-0.1

Table F-3
Potential Project Cost Estimates for Major Projects

<i>Project Description</i>	<i>Construction Cost</i>	<i>Right-of-way Cost*</i>	<i>Total Cost</i>
US 70 Widening	\$3,379,500	\$1,008,740	\$4,388,240
Catawba Avenue Widening	\$1,211,250	\$759,150	\$1,970,400

* Right-of-way costs estimates were derived using average land costs/acre for McDowell County

Thoroughfare Plan Tabulation

The following pages provide a detailed tabulation of all the streets identified as elements of the Old Fort Thoroughfare Plan. The table includes a description of each section, as well as the length, cross-section, and right-of-way for each section. Also included are existing and projected average daily traffic volumes, roadway capacity, and the recommended ultimate lane configuration. Please refer to Appendix B for a listing of terms helpful in interpreting the table. Appendix C includes a full description and illustrative figure for each of the alpha-codes shown in the table.

Table F-4 Old Fort Street Tabulation

Street Section	Length		Cross Section		Right-of-way		Avg Daily Traffic		No. of Lanes		Capacity	
	miles	km	feet	meters	ft	meters	1994	2025	Existing	Recc.	Existing	Recc.
I 40												
West UPB - US 70	0.30	0.48	72	21.95	350	106.7	27,000	55,000	6L	ADQ	81,000	81,000
US 70 - Catawba Ave	0.74	1.19	48	14.63	250	76.2	23,100	47,000	4L	ADQ	54,000	54,000
Catawba Ave - East UPB	2.06	3.32	48	14.63	300	91.5	24,100	49,000	4L	ADQ	54,000	54,000
US 70												
common I 40	-	-	-	-	-	-	-	-	-	-	-	-
I 40 - WCL Old Fort	0.49	0.79	22	6.71	100	30.49	4,000	9,200	2L	2L/K	11,000	13,000
WCL Old Fort - Catawba Av	0.35	0.56	24	7.32	UNK	UNK	5,600	12,900	2L	2L/K	12,000	13,000
Catawba Av - Spring Street	0.09	0.15	40	12.19	UNK	UNK	5,600	12,900	2L	2L/K	9,700	13,000
Spring Street - Church Street	0.07	0.11	34	10.36	UNK	UNK	8,300	19,000	2L	3L/H	9,700	21,400
Church Street - Red Town Rd	0.28	0.45	30	9.15	UNK	UNK	8,300	19,000	2L	3L/H	9,700	21,400
Red Town Rd - East UPB	1.18	1.90	22	6.71	100-60	30.49	8,300	19,000	2L	4L/G	11,000	33,500
Catawba Av (SR 1103)												
UPB - Sugar Hill	0.15	0.24	18-20	6.10	UNK	UNK	3,000	7,000	2L	2L/K	8,000	10,500
Sugar Hill - I 40	0.53	0.85	18-20	6.10	UNK	UNK	6,700	15,500	2L	4L/G	8,000	33,500
I 40 - US 70	0.45	0.73	50	15.24	UNK	UNK	8,400	19,400	4L	ADQ	33,500	ADQ
Curtis Creek Road (SR 1227)												
US 70 - Old Fort UPB	0.28	0.45	20	6.10	UNK	UNK	200	650	2L	2L/K	8,000	10,500
Greenlee Road (SR 1246)												
US 70 - Padgett Road	1.10	1.77	18	5.49	UNK	UNK	300	700	2L	2L/K	7,500	10,500
Lackeytown Rd (SR 1235)												
UPB - Oakdale Rd	0.70	1.13	20	6.10	UNK	UNK	700	1,500	2L	2L/K	8,000	10,500
Oakdale Rd - ECL Old Fort	0.10	0.16	20	6.10	60	18.29	1,100	2,500	2L	2L/K	8,000	10,500
ECL Old Fort - US 70	0.33	0.53	20	6.10	60	18.29	1,100	2,500	2L	2L/K	8,000	10,500
Oakdale Rd (SR 1234)												
Lackeytown Rd - UPB	0.95	1.53	20	6.10	UNK	UNK	300	700	2L	2L/K	8,000	10,500
Realignment to Padgett Rd	n/a	n/a	24	7.32	100	30.49	n/a	700	n/a	2L/K	N/A	10,500

Table F-4 Old Fort Street Tabulation

Street Section	Length		Cross Section		Right-of-way		Avg Daily Traffic		No. of Lanes		Capacity	
	miles	km	feet	meters	ft	meters	1994	2025	Existing	Recc.	Existing	Recc.
Old US 70 (SR 1407)	0.30	0.48	20	6.10	UNK	UNK	500	1,100	2L	2L/K	8,000	10,500
US 70 - NCL Old Fort	0.85	1.37	18	5.49	UNK	UNK	500	1,100	2L	2L/K	7,500	10,500
NCL Old Fort - UPB												
Padgett Road (SR 1240)	0.30	0.48	20	6.10	60	18.29	400	800	2L	2L/K	8,000	10,500
Greenlee - Oakdale Road												
Southern Connector												
Bat Cave Rd - Lackeytown Rd	n/a	n/a	24	7.32	100	30.49	n/a	2,000	n/a	2L/K	n/a	10,500
Sugar Hill (SR 1135)												
UPB - Catawba Av	0.15	0.24	24	7.32	60	18.29	3,300	7,600	2L	ADQ	10,500	10,500

FIGURE F-1

AVERAGE DAILY TRAFFIC OVER CAPACITIES

LEGEND

1994 ADT
PROJECTED 2025 ADT
ROADWAY CAPACITY



PROPOSED ROADWAY - - - -



OLD FORT MCDOWELL COUNTY NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION



FIGURE F-2

LEGEND

	existing	proposed
FREEWAY		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY:

Old Fort AUGUST 22, 1995

N.C. Dept. of Transportation OCTOBER 8, 1995

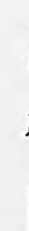
RECOMMENDED BY:

Statewide Planning SEPTEMBER 19, 1995

Public Hearing Date AUGUST 21, 1995

THOROUGHFARE PLAN

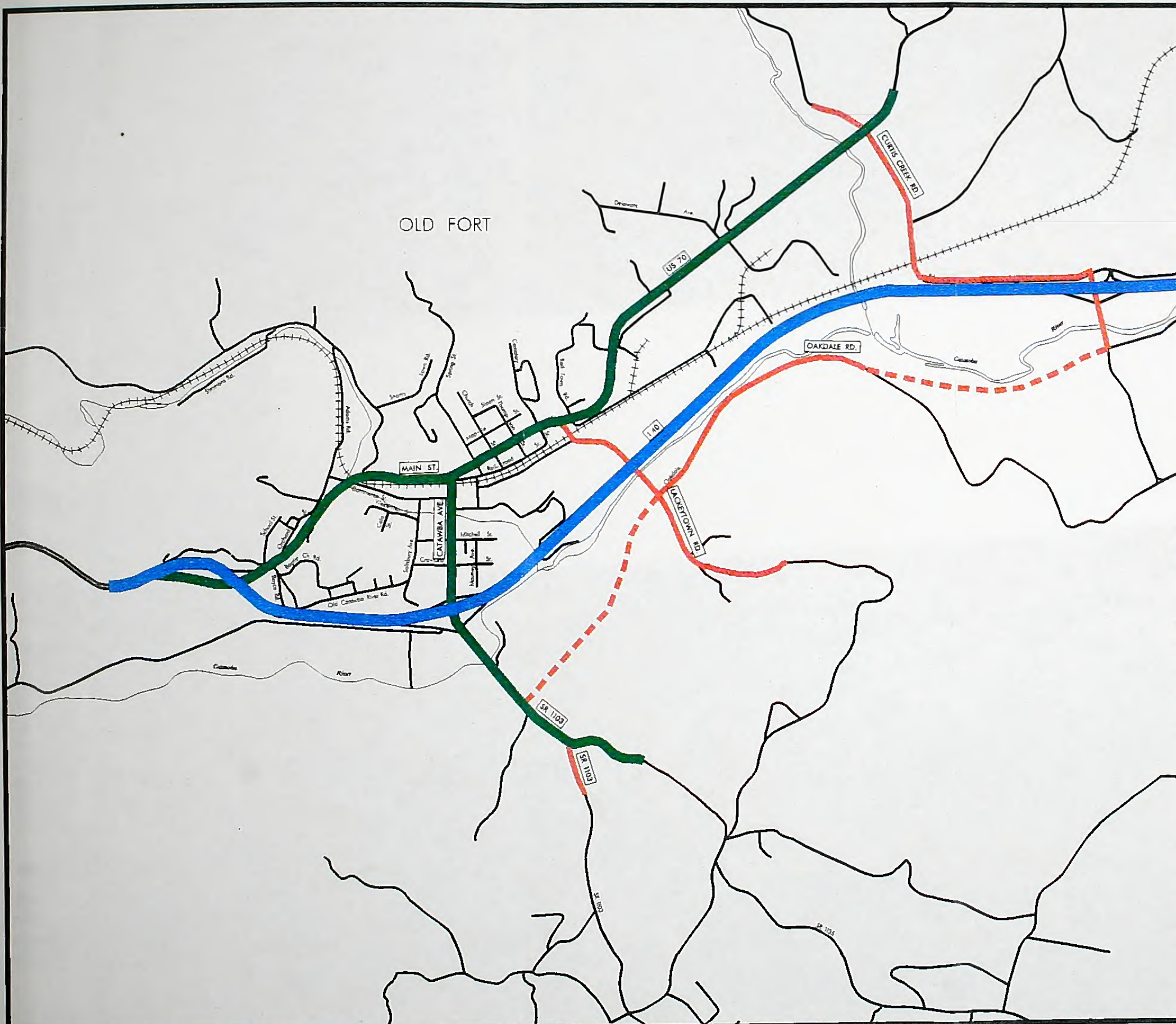
July 21, 1995



OLD FORT
MCDOWELL COUNTY
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION



Appendix G

Assessment of the 1984 Marion Thoroughfare Plan

In lieu of a comprehensive thoroughfare plan study, the City of Marion requested an overview of the 1984 Marion Thoroughfare Plan. This decision was based primarily on the cost associated with the data collection for and the development of a comprehensive model study. This Appendix includes a review of the projects in the 1984 Marion Thoroughfare Plan Report with particular attention to the elements identified in the initial meeting with the City in August of 1994. These elements include:

- Changes in traffic patterns since the completion of the US 221 Marion Bypass
- Main Street/Downtown traffic
- US 221/US 70 intersection
- Sugar Hill Road (including the intersection with Rankin Drive)
- Baldwin Road (including the intersection with Rutherford Road)

Primary Concerns

The following is a review of the primary transportation concerns expressed by McDowell County and the City of Marion with regard to the Marion Thoroughfare Plan.

US 221 Marion Bypass

The 1994 Average Daily Traffic (ADT) counts show that the US 221 Marion Bypass carries an average of 9,200 - 10,900 vehicles per day. US 221 Business through Marion carries from 10,000 - 19,700 vehicles per day. Clearly, if the Bypass were not in place the impact of the traffic congestion in downtown Marion would be severe. The Bypass has shifted through traffic out of the downtown area as well as provided a quick and efficient means of traveling in and around the City of Marion. As a result of the attractiveness of accessing the Bypass, traffic volumes on other roadways may have increased, and land use patterns shifted. However, without the development of a comprehensive transportation model that utilizes comprehensive traffic counts, employment data, and a classification of the existing housing stock, it is difficult to fully assess the impact that the Bypass has had on traffic volumes and/or land development.

Main Street/Downtown Traffic

The 1984 Thoroughfare Plan forecasted that the US 221 Marion Bypass would greatly relieve Main Street traffic. An analysis of traffic volume trends supports this theory. This analysis shows that traffic volumes along Main Street and other major routes in the downtown area declined after the opening of the Bypass. However, this traffic is now on

a upward trend primarily due to an increase in traffic with destinations that are likely local in nature. The continued and growing use of Main Street by local traffic accessing areas in and around Marion has resulted in continued traffic congestion in the downtown area, especially during peak periods. Based on the limited nature of this review, I am unable to make definite recommendations for alleviating this congestion other than the unpopular choice of removing on-street parking. If at some point the City feels that traffic in the downtown area is becoming detrimental to the economic stimulus of the area, the City should consider requesting a comprehensive transportation study that will better address the causes and solutions of transportation problems in and around the central business district.

Sugar Hill Road (SR 1001)

This is a major north-south radial that interconnects residential development south of Marion, Interstate 40, and the heart of Marion's central business district. Sugar Hill Road via Rankin Drive also provides access to McDowell Hospital. The 1984 Marion Thoroughfare Plan recommends that this roadway be widened to provide a 4-lane divided section from Interstate 40 to the US 221 Marion Bypass and a 5-lane urban section from the Bypass to Old Henderson Road. The 5-lane section is complete and the 4-lane section is included in the most recent Transportation Improvement Program (R-2643). This final improvement will alleviate traffic congestion and improve travel along this important radial.

Baldwin Road

Baldwin Road provides a connection between US 70 and Rutherford Road (US 221 Business/NC 226) which allows motorists to circumvent downtown traffic congestion. As the downtown area becomes increasingly congested, this road will become even more attractive as a radial connector. Baldwin Road also provides land access to residential, commercial, and industrial development. A large industrial site, Marion Manufacturing, is accessed from Baldwin Road resulting in further traffic demand, especially during shift changes.

The 1984 Thoroughfare Plan did not propose any improvements to this minor thoroughfare. The existing alignment is a narrow 2-lane roadway. The intersection of Baldwin Road with US 70 is signalized. Baldwin Road at Rutherford Road is a "T-type" intersection and is signalized. There is a commercial business directly across from this intersection that appears to generate a large amount of traffic. This business has no apparent driveway control and traffic movements in this vicinity are somewhat erratic.

Widening Baldwin Road to provide a minimum of two 12-foot lanes with paved shoulders would enhance the use of this radial connector. Making improvements at the intersections of Baldwin Road with Rutherford Road and US 70 could greatly improve safety and operational efficiency at these intersections. These locations should be studied further to determine the feasibility of adding turn lanes at both intersections and a traffic signal at Rutherford Road.

US 221/US 70 Intersection

The intersection of US 221 and US 70 is one of the busiest intersections in the Town of Marion. According to the Division 13 Traffic Engineer, this intersection was signalized in October of 1990. US 221 carries approximately 10,900 vehicles per day in the vicinity of this intersection and US 70 carries approximately 11,100 vehicles per day. An investigation into the accident history at this intersection indicates that there were a total of 52 accidents over the three year study period. Forty percent of these accidents were classified as rear end type accidents, nineteen percent were angle accidents, and twenty three percent were left turning accidents.

Both the number of accidents and the severity of the accidents are considered when investigating accident data. The severity of every accident is measured with a series of weighting factors developed by NCDOT's Division of Highways. In terms of these factors, a fatal or incapacitating accident is 47.7 times more severe than one involving only property damage. An accident resulting in minor injury is 11.8 times more severe than one with only property damage. The average accident severity for this location was 10.57. This number indicates that the average accident occurring at this location is a minor accident generally resulting in property damage only. The pattern and severity of accidents at this location is not unusual for a signalized intersection with high average daily traffic. The accident problem appears to be a result of traffic congestion and driver error.

Based on this preliminary study, the traffic congestion at this intersection appears to be system wide in nature. Without the benefit of a computer model to evaluate system wide problems, no recommendations to alleviate congestion can be made at this time.

1984 Plan Elements

The following is a summary of additional elements covered in the 1984 Marion Thoroughfare Plan Report, but not directly discussed in the previous section. These projects were field assessed to determine the continued feasibility for providing an adequate transportation system for Marion and the surrounding area.

Logan Street Extension

Logan Street is a 2-lane roadway with parking. This route provides a major north-south route through Marion. The southern terminus of Logan Street is currently at Henderson Street. The 1984 Thoroughfare Plan recommends extending Logan Street to Rutherfordton Road. This extension will require bisecting two parking lots and will impact a residential area beyond these lots. The 1984 Plan addresses the need for this extension in coordination with the development of a downtown mall on Main Street. The primary role of this project would be to handle the diverted Main Street traffic. Since the downtown mall has not been constructed this project is not needed. However, if other methods offer no relief, the construction of this extension may help to relieve future congestion on Main Street.

North McDowell Street Extension

When complete this roadway will serve as a north-south cross-town thoroughfare on the east side of the central business district. It provides a connection with residential areas to the north and south to business and commercial development on the east side of Marion.

At the time of this review, this project had not been completed. Based on a field investigation, it appears that this would still be a beneficial project for the City of Marion to pursue.

Robinson Road Extension

This extension will provide a needed connection through existing residential development on the north side of Marion. At the time of this review, this project had not been completed. Based on a field investigation, it appears that this would still be a beneficial project for the City of Marion to pursue.

Virginia Road Extension

The Virginia Road Extension will serve as a residential connector route for development on the northeast outskirts of the City. At the time of this review, this project had not been completed. Based on a field investigation, it appears that this would still be a beneficial project for the City of Marion to pursue.

East Court Street (US 70 E)

This is a major east-west radial that carries industrial traffic as well as residential and tourist traffic. The 1984 Thoroughfare Plan recommends that East Court Street be widened to 5-lanes from Garden Street to Madison Street, 4-lanes from Madison Street to SR 1515, and then minor widening from SR 1515 to SR 1537.

A field review indicates that this project has not been completed. However, the portion of East Court Street (US 70) between Madison Street and Church Street has been widened to accommodate a 3-lane section. The recommendations contained in the 1984 Thoroughfare Plan are still feasible and justified.

US 221/NC 226

Identified as one of the busiest radials in the Marion Planning Area by the 1984 Thoroughfare Plan study, this route carries a high percentage of truck traffic as well as a significant portion of tourist traffic. The 1984 Thoroughfare Plan recommends widening US 221/NC 226 to 4-lanes from Montevista Avenue to SR 1501. Widening to 4-lanes was also recommended for the southern section, from South Main Street to the separation of US 221 and NC 226.

A field review shows that the existing cross-section for US 221/NC 226 is as follows: from the Bypass to Morgan Street, 2-lanes; beyond Morgan Street begin 3-lane section; at State Street begin 4-lane section with parking; end parking at East Court Street; begin the

5-lane section at Logan Street; at the turn off for US 70 begin a 2-lane section. Based on a review of land use and traffic volumes, the recommendations from the 1984 Plan are still valid.

1984 Thoroughfare Plan Report

For additional information regarding the 1984 Marion Thoroughfare Plan analysis, please refer to the Marion Thoroughfare Plan Report published in October of 1984 by the North Carolina Department of Transportation. This report includes the Thoroughfare Plan street tabulation, and the travel forecast model technical data.

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